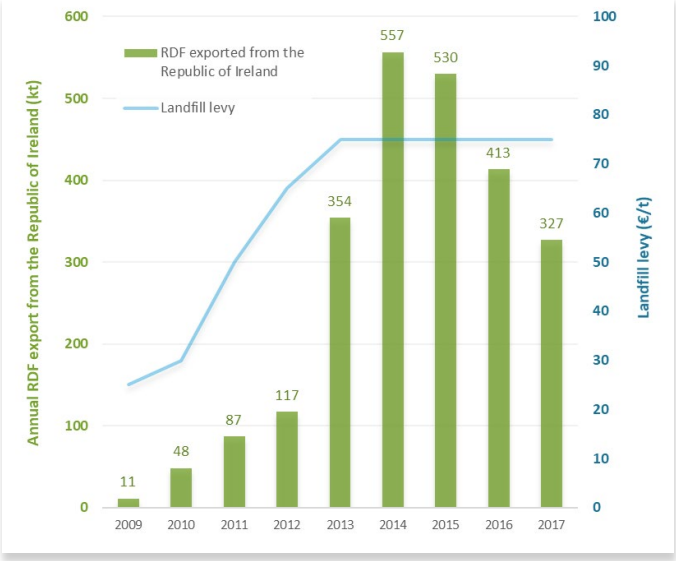
CIWM

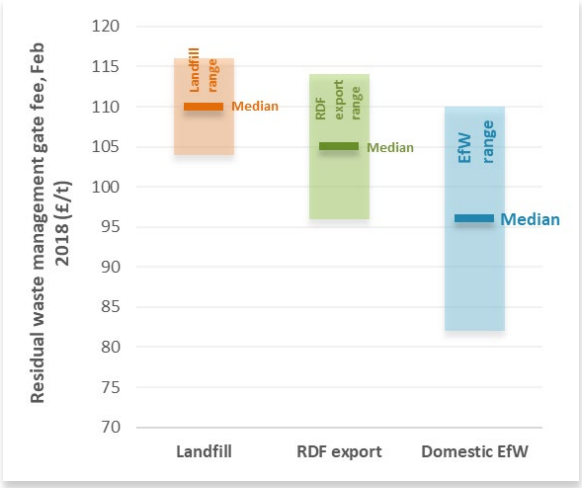
CIWM Presidential Report 2018

RDF Trading in a Modern World

EXECUTIVE SUMMARY

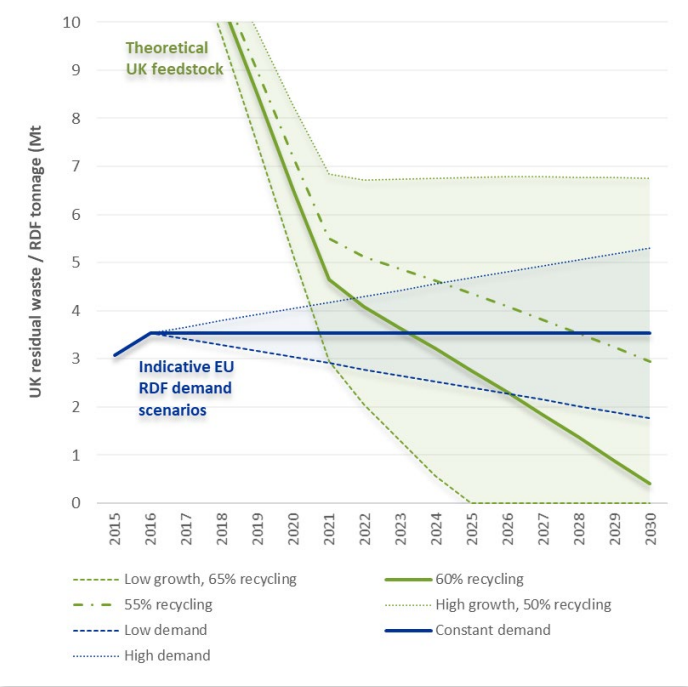
- Emerging over the last decade in a response to the landfill levy/tax and European demand, RDF exports now play a significant role in the management of residual waste in the Republic of Ireland and the UK.
- Across the Republic of Ireland and the four UK administrations, RDF exports have played an important role in making beneficial use of residual waste that would otherwise have been disposed to landfill, in lieu of domestic energy from waste (EfW) capacity.
- However uncertainties exist around the future of the industry. Pressures include the possible impact of rising recycling rates coupled with domestic energy from waste capacity, as well as ramifications of Brexit on the economics of export from the UK. In this context, CIWM has commissioned the 2018 Presidential Report to assess the current state of the RDF exports, and consider how the sector may evolve out to 2030.





- Analysis of the most recent publicly available data indicates that **RDF exports from the Republic of Ireland have declined significantly over the last two years**, as illustrated by the time series above.
- For the case of **England, export tonnages appear to have largely plateaued**. Scotland and Wales currently place relatively little reliance on RDF exports, while Northern Ireland has the greatest reliance on exports on a per capita basis.
- The most recent available data on UK export prices, shown left, indicates that RDF occupies an intermediate cost niche between landfill (for which tax is the overwhelming component) and domestic EfW, which is relatively inexpensive.

EXECUTIVE SUMMARY *(continued)*



- To inform understanding of the outlook for exports, SLR has developed mass balance projections for waste sectors in the Republic of Ireland and the UK. In both countries, forecasts show that **in the event that the EU Circular Economy Package (CEP) 2030 requirement for 60% recycling is achieved, RDF exports will contract dramatically**.
- Notwithstanding this overarching finding, differing market conditions prevail in the Republic of Ireland and the four UK administrations. As noted above, it appears that **in the Republic of Ireland, new domestic EfW capacity has already begun to impact on export volumes, with further reductions expected in the early 2020s**.
- In England, build out of domestic EfW capacity will reduce remaining volumes of residual waste, intensifying competition with landfills to secure feedstock for RDF production. The long term outlook for exports from England is highly dependent on the municipal waste recycling rate achieved.

- In per capita terms, **Northern Ireland currently places the greatest reliance on RDF exports** (circa 80 kg/person/yr). In the absence of any negative impacts of Brexit on the economics of Brexit, this position is likely to continue until domestic EfW capacity is delivered in NI.
- **For Scottish councils currently focussed on achievement of the 2021 ban on landfill of biodegradable waste, RDF exports may provide a cost effective short term solution** (other potential options include haulage to EfW facilities or landfills in the north of England).
- RDF exports from Wales are currently limited, and with large scale EfW facilities in operation in the south, and in construction in the north, this situation is likely to continue.

EXECUTIVE SUMMARY *(continued)*

- While market dynamics and outlooks vary in the Republic of Ireland and across the UK in all countries, RDF exports continue to play a valuable interim role diverting material from landfill.
- For the UK, the Brexit process nevertheless raises the possibility that the practice of exporting RDF will become less economic. While it is likely that tariffs would be waived under EU import rules, an onerous customs regime would add to transport times and administrative burdens.
- The UK Government can help to limit these impacts by pressing for continuing free movement of RDF, regardless of the ultimate outcome of Brexit negotiations.

OVERVIEW

1. BACKGROUND AND SCOPE

- Each year, CIWM commissions its annual Presidential Report, providing decision makers with analysis of critical issues facing the waste and resources sector.
- In 2018, CIWM has chosen to explore RDF export markets in the Republic of Ireland and UK. The objective is to stimulate debate and inform decision makers in both countries about likely future changes in this sector in the medium and longer term up to 2030, as processing capacity increases in the UK and Republic of Ireland and the UK leaves the EU.
- To this end this report considers the following aspects:
  - A brief history of the trajectory of development of the RDF export market in each country, highlighting underlying factors and regulatory approaches (section 2).
  - Characterisation of the current structure of the market, including exporting companies, destinations, specifications and pricing (section 3).
  - Mass balance forecasting for Republic of Ireland and the UK, setting out scenarios for the future residual waste treatment capacity gap (section 4).
  - Review of market influences including Brexit, European demand, quality standards (section 5), etc.
  - Discussion of the future outlook for export volumes, exploring potential future outcomes under varying national recycling levels (section 6).
  - Consideration of the various interests in the RDF export market, and how these parties may best position themselves for the future (section 7).

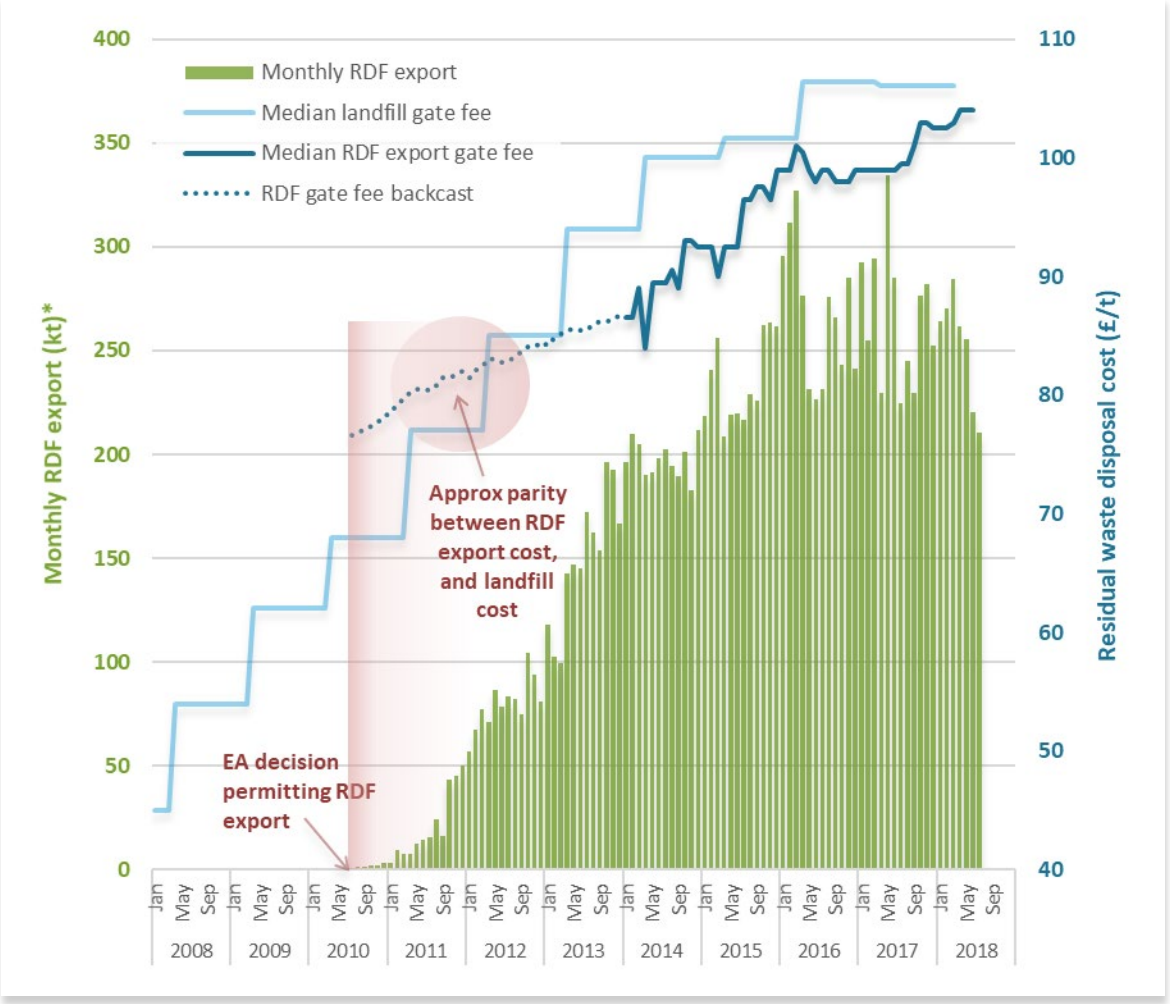
2. A BRIEF HISTORY

- The practice of exporting RDF to mainland Europe has expanded rapidly over the last decade and now plays an important role in the waste management systems of both the Republic of Ireland and the UK.
- To set the scene, this section assesses the level of growth in RDF exports, and considers how and why this shift has occurred in the Republic of Ireland and UK.
- Available datasets on RDF exports are used to construct historical time-series, demonstrating the evolution of RDF exports in response to market drivers.
- Taking each country separately (including the Republic of Ireland and the four UK administrations) a concise overview is then provided of the current approach to RDF export regulation, drawing out key differences between nations.

2. A BRIEF HISTORY

2.1 Development of the Export Market

- Beginning in 2010, RDF exports have risen steadily, and are now making a major contribution to management of residual waste in the UK and Republic of Ireland.
- This rise can largely be attributed to the confluence of three key factors:
  - Rising landfill levy in the Republic of Ireland, and UK landfill tax resulting in parity between the cost of landfill and RDF export (illustrated in the plot opposite for England).
  - (Specific to England and Wales) an Environment Agency decision in June 2010 stating that exports of treated municipal waste 'are potentially permitted'.
  - The emergence of an energy from waste (EfW) capacity gap in Western and Northern Europe.
- Focussing on the case of England, the impact of these factors is illustrated opposite.



* As reported by the EA (England and Wales to November 2014, England only thereafter).

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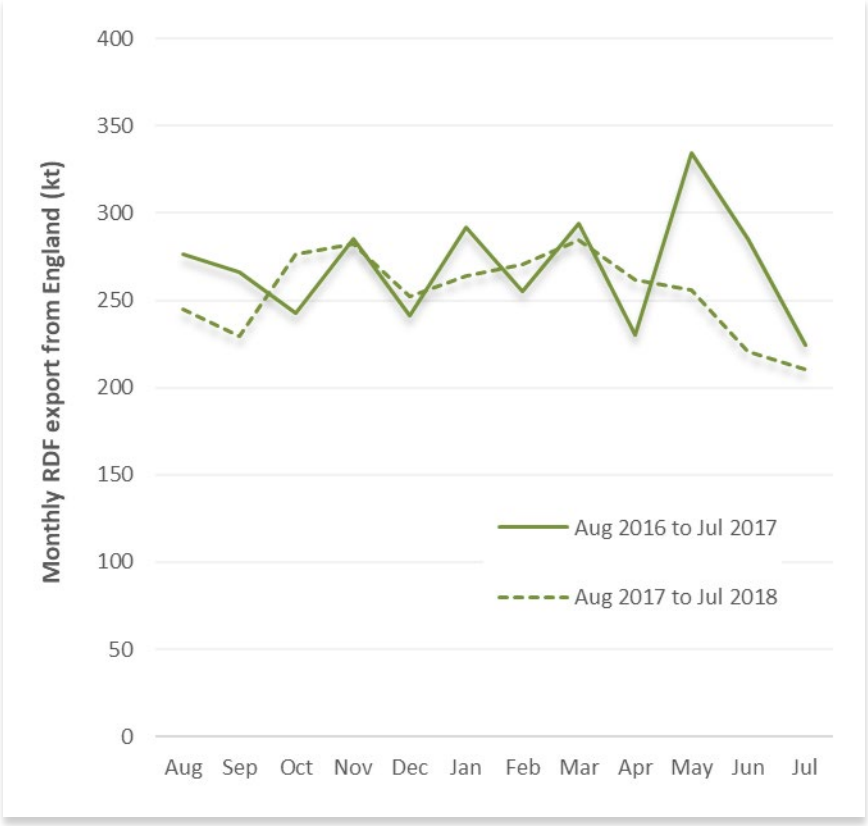
2. A BRIEF HISTORY

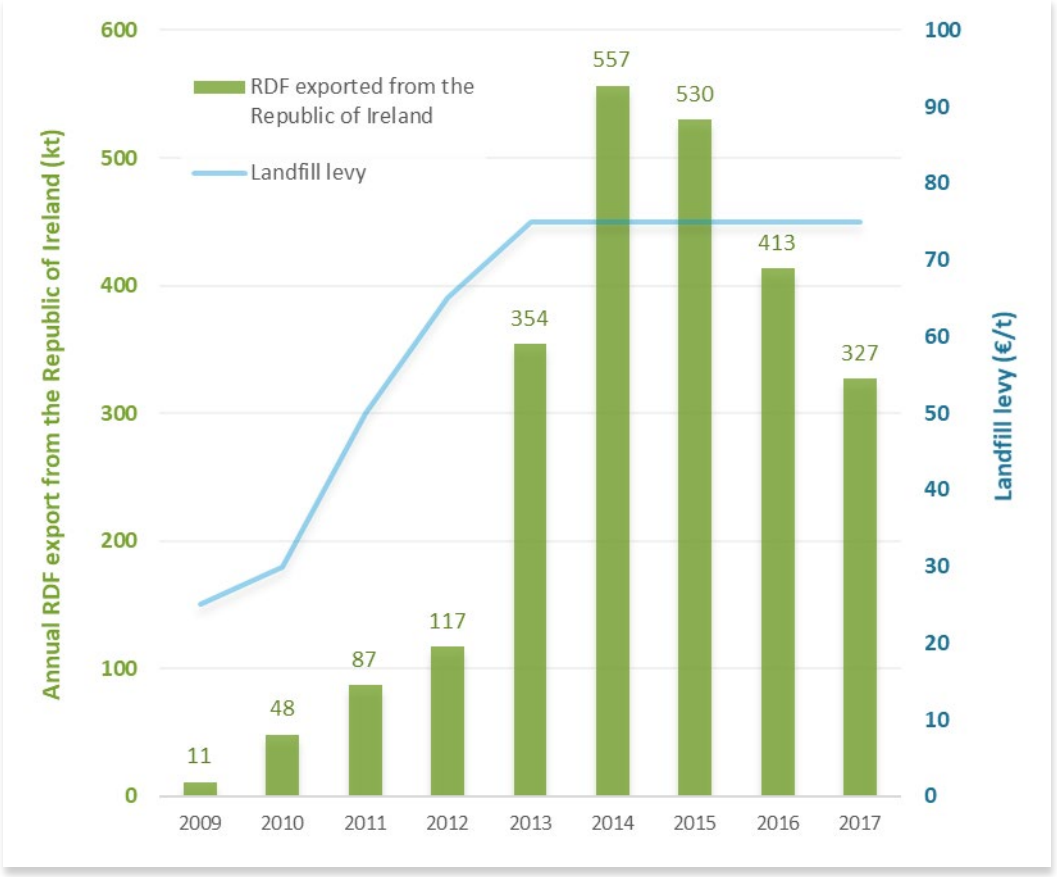
2.1 Development of the Export Market

- Reported RDF exports in England appear to have reached a plateau, totalling circa 3.2 Mt in calendar years 2016 and 2017.
- Opposite, provisional Environment Agency export tonnage data for the period August 2017 to July 2018 is compared with the time series for the previous 12 month period.
- Monthly exports over the period August 2017 to July 2018 total 3.05 Mt – reducing by 5% relative to 3.23 Mt recorded over August 2016 to July 2017.
- However, given the magnitude of monthly variation in the reported export tonnage, this result may simply be the result of short term fluctuation, rather than genuine contraction in the market.



2. A BRIEF HISTORY

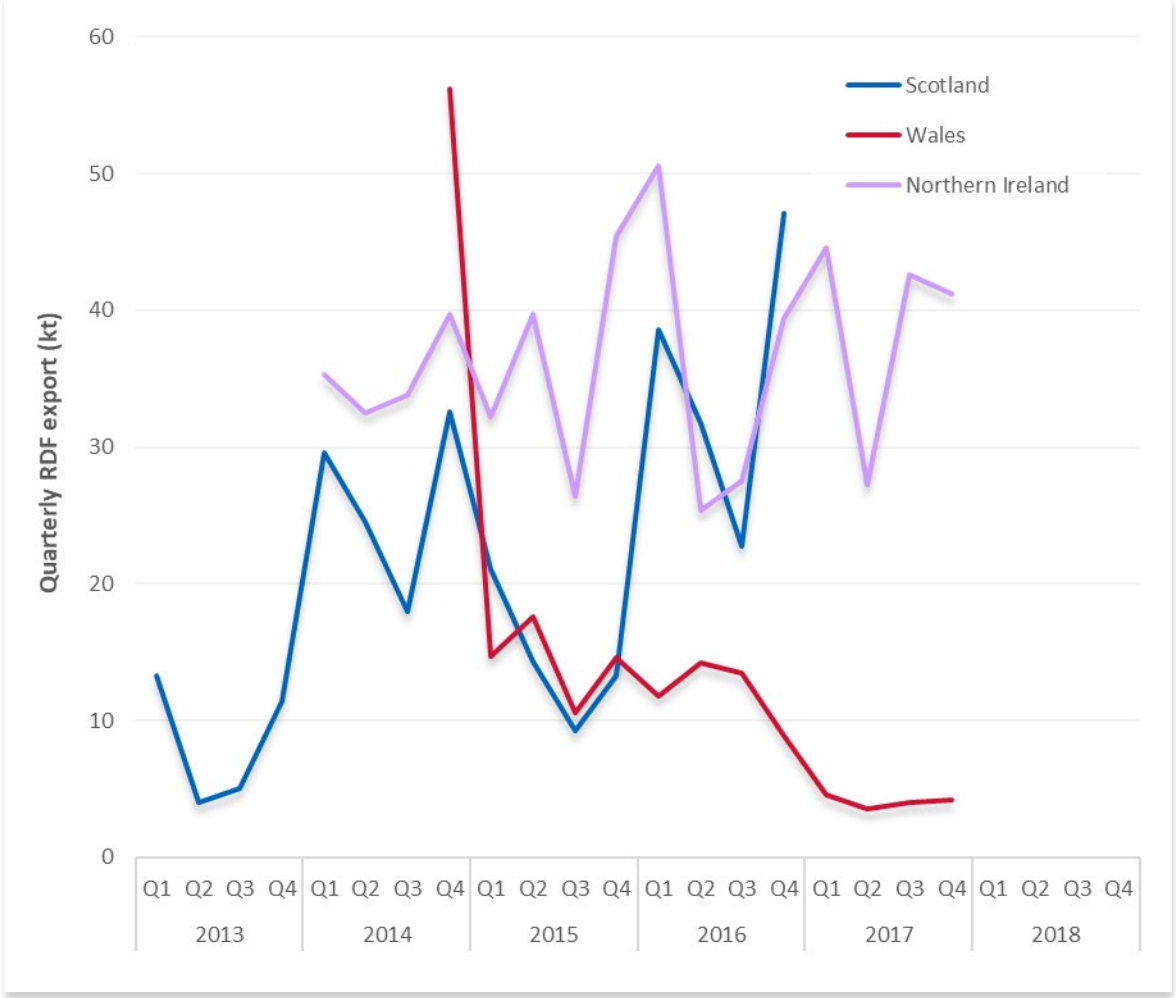
2.1 Development of the Export Market *(continued)*



- In the Republic of Ireland, paralleling the increase in the landfill levy, RDF exports increased dramatically between 2009 and 2014.
- However, analysis of recent data indicates a reversal of this upward trend: reported RDF exports in 2016 fell by 115 kt (or 22%) relative to 2015, and by a further 87 kt (21% drop) in 2017.
- This recent reduction is likely as a result of greater quantities of residual waste being used to generate energy domestically.
- In contrast, analysis of the most recent RDF export datasets published by the Environment Agency indicate more stable volumes for England. Focussing on the latest 12 month rolling period through to April 2018, the total exported volume of 3.2 Mt is 0.1 Mt higher than the corresponding previous 12 month period.

2. A BRIEF HISTORY

2.1 Development of the Export Market *(continued)*

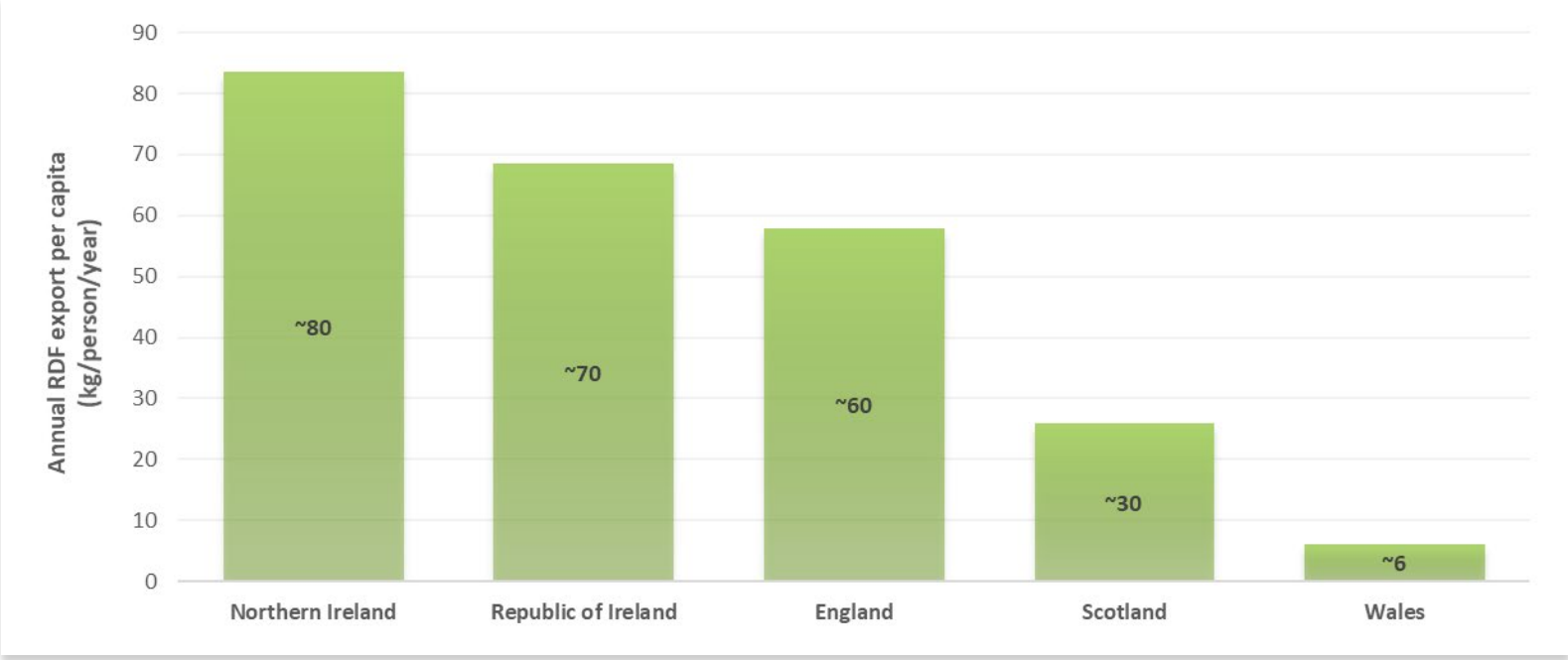


- Export data for Scotland, Wales, and Northern Ireland is illustrated left, aggregated on a quarterly basis.
- With relatively low tonnage exports, export datasets show substantially more 'noise'.
- However, Welsh data notably indicates a decline in reliance on RDF exports since 2015, while Scottish data shows an increase between 2013 and 2016.

2. A BRIEF HISTORY

2.1 Development of the Export Market *(continued)*

- The relative importance of RDF exports in the waste sectors of each country can be gauged by determining quantities of RDF exported per capita in each country:



- On a per capita basis, Northern Ireland currently has the greatest reliance on RDF exports at circa 80 kg/person/year. It should be noted that while the Republic of Ireland now ranks second above at 70 kg/person/year, exports from the Republic of Ireland peaked at over 110 kg/person/year in 2015.
- England exports amount to circa 60 kg/person/year, while in Scotland and Wales, RDF export plays a relatively small role on a per capita basis.

2. A BRIEF HISTORY
2.2 Regulatory Approaches

- Overarching legislation governing RDF export at EU level is the EC Waste Shipment Regulations (WSR), in tandem with the revised Waste Framework Directive (WFD).
  - Export of RDF for energy recovery is permitted under the WSR 'Amber' waste list, which permits export given prior notice (generally annual) to relevant authorities.
  - 'Recovery' is defined as per the WFD, with the requirement that material is exported to a facility falling under the R1 definition 'use principally as a fuel or other means to generate energy' (this classification being determined by application of an energy efficiency formula).
  - Shipments of materials falling under the Amber waste list are permitted subject to prior written notification and consent procedures.
- EC Waste Shipment Regulations are then interpreted via national level regulations:
  - The WSRs are enacted in the Republic of Ireland via the Ireland Waste Management (Shipments of Waste) Regulations, 2007.
  - In the UK, requirements for compliance with the WSR are set out in the policy document 'UK Plan for Shipments of Waste'.
- Interpretation of EC Waste Shipments Regulations, and enforcement of procedures for RDF export, is the responsibility of relevant agencies in each country:
  - In Republic of Ireland, RDF exports are controlled by the National Trans-Frontier Shipments Office (NTFSO), which is part of Dublin City Council. Application of European Waste Catalogue codes to exported materials is the responsibility of the Environmental Protection Agency (EPA).
  - RDF exports from the UK fall under the control of the Environment Agency (EA), Northern Ireland Environment Agency (NIEA), Natural Resources Wales (NRW) and Scottish Environment Protection Agency (SEPA).

A tabular summary of the regulatory approach adopted in each nation is included overleaf.

Country / regulator	Regulatory approach
Republic of Ireland / NTFSO and EPA	Under the EPA's implementation of the EC WSRs, export of RDF for energy recovery is permitted under the WSR 'Amber' list of waste exports, prior notice being required. Notifications are made to the NTFSO, which regulates shipments. Under EPA interpretation of shipping regulations, export of wastes under European Waste Catalogue (EWC) codes 19 12 12 (mechanically treated waste) and 19 12 10 (refuse derived fuel) is permitted, as is export of mixed municipal waste coded 20 03 01 (this is in contrast to the case in England, Scotland and Wales, as detailed below). The EPA take a relatively prescriptive approach in defining what qualifies as RDF. Specifically, to convert waste under EWC code 20 03 01 (mixed municipal waste) to codes 19 12 12 (mechanically treated) or 19 12 10 (RDF), there is a requirement to apply a "*treatment process that substantially alters the properties of the waste*". Examples of qualifying processes cited by the EPA include the following: • "*Trommelling or screening of waste to produce oversize and fines residues combined with other processes including magnets, manual picking lines, blowers, wind-shifters, eddy currents etc.*" • "*Mechanical separation, blending and compressing to increase the calorific value of the waste and produce RDF/SRF**" The EPA guidance also provides the specific evidence base which RDF producers and exporters should have in place to justify coding as 19 12 12 and 19 12 10.
England – Environment Agency / Defra	In England, the commencement of RDF exports in 2010 has been attributed to a decision made by the Environment Agency interpreting the UK Plan for Shipments of Waste: • This decision confirmed that export of "untreated" municipal waste (EWC 20 03 01) is prohibited. Under the EA interpretation, export of untreated mixed municipal waste under EWC code 20 03 01 is prohibited by the WSRs, with this waste code regulated as per waste streams sent for disposal.

2.2 Regulatory Approaches *(continued)*

Country / regulator	Regulatory approach
England – Environment Agency / Defra *(continued)*	• Export of treated municipal waste was, however, confirmed as sanctioned. • Critically, no strict definition of "treated" was applied, allowing for relatively basic processes including shredding, sorting and compaction. Export is permitted under EWC codes 19 12 10 and 19 12 12– in practice the majority of reported material is coded 19 12 10, regardless of the level of processing applied. Notably, as of February 2017, Defra has adopted a definition of RDF (albeit light-touch): *'Refuse derived fuel (RDF) consists of residual waste that complies with the specifications in a written contract between the producer of the RDF and a permitted end-user for the thermal treatment of the waste in an energy from waste facility or a facility undertaking co-incineration such as cement and lime kilns. The written contract must include the end-user's technical specifications relating as a minimum to the calorific value, the moisture content, the form and quantity of the RDF.'*. Critically, while this approach does not prescribe a particular approach to treatment or a specification, there is a requirement for operators to put in place a form of contract with EfW end users and define basic RDF properties.
Natural Resources Wales	Established in 2013, NRW has maintained a regulatory position similar to that applied by the EA in England. Export data specific to Wales is available from November 2014 onwards. Notably, NRW information on controls applying to international waste shipments references the waste exports control tool provided by the EA. While the Welsh approach to regulation of RDF exports largely parallels that in England, it is notable that Welsh Government policy shows preference for self-reliance in EfW capacity. Welsh government funding for residual waste treatment is specifically made available for domestic EfW projects only.
Northern Ireland / NIEA	In Northern Ireland, a regulatory position statement allowing for the temporary storage of RDF pending export explicitly allows for EWC code 19 12 10 only. In practice, this is likely to be a formality, exported RDF being similar to material exported from the rest of the UK. With the exception of this requirement, regulation of RDF exports is in line with the 'light touch' approach taken in England and Wales.

Country / regulator	Regulatory Approach
Scottish Environment Protection Agency	SEPA's position statement on RDF exports confirms that Scotland parallels Northern Ireland in strictly applying the RDF-specific EWC code 19 12 10. However, no specific guidance or definition exists regarding the level of pre-treatment required to achieve classification under EWC 19 12 10 – it is therefore assumed that approval of the material is at the discretion of SEPA local officers. SEPA do, however, impose waste management licensing requirements for RDF production plants, and temporary dockside storage of RDF. Storage at intermediate sites is permitted for up to 3 months, while storage at the dockside pending export is limited to 4 kt, for a maximum period of 5 days.

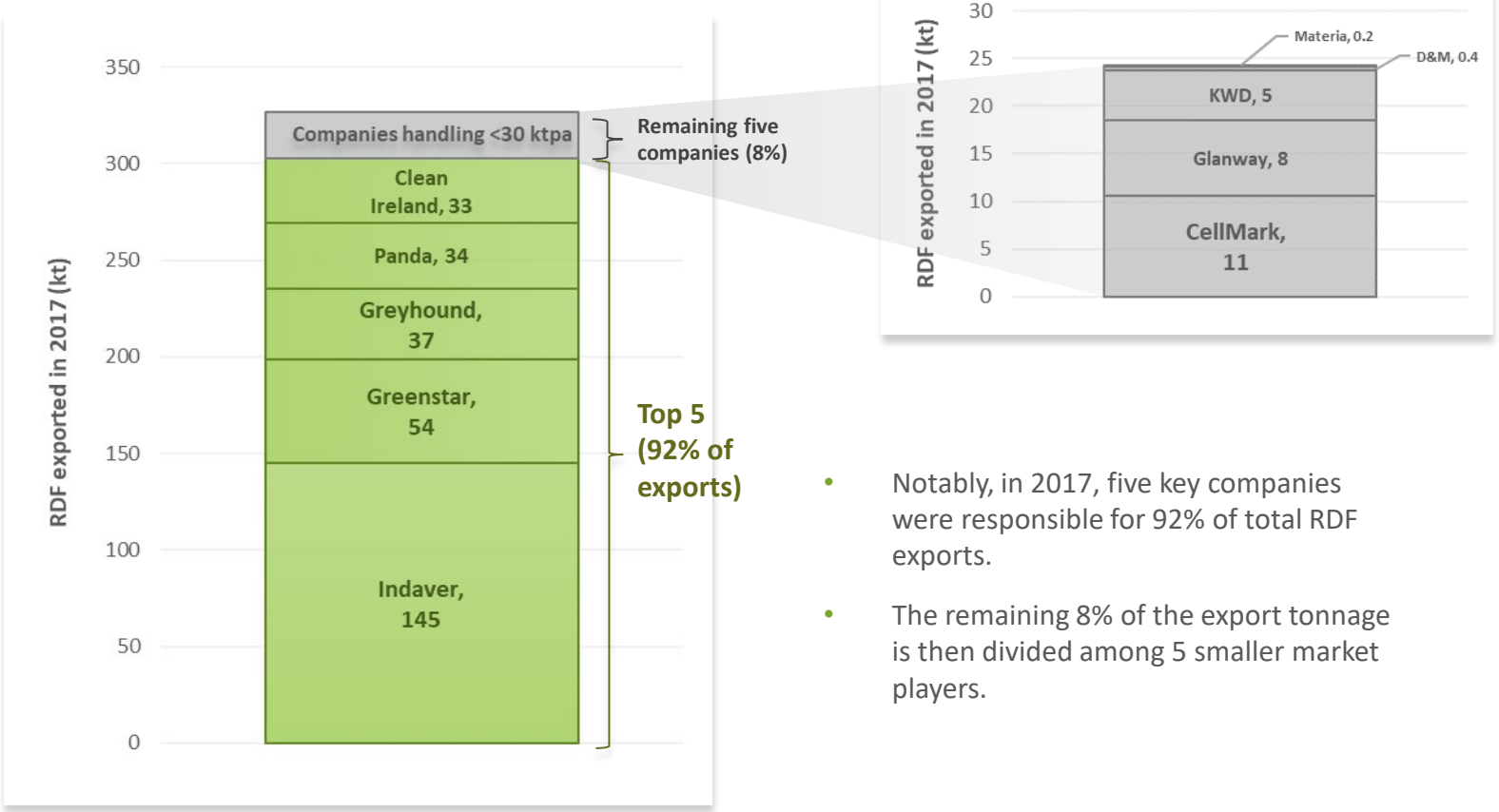
3. WHAT DOES THE MARKET CURRENTLY LOOK LIKE?

- Following on from the historical context provided above, this section takes a more granular look at the RDF export sector, including:
  - A summary of the main market players currently exporting from the Republic of Ireland and the UK.
  - Analysis of export flows demonstrating the main ports of exit.
  - Summary of the European destination countries receiving exported material.
  - A review of end user specifications for exports.
  - An indication of the comparative pricing of RDF export vs domestic EfW and landfill.

3. WHAT DOES THE MARKET CURRENTLY LOOK LIKE?

3.1 Exporting Companies (Republic of Ireland)

- Using the National TransFrontier Shipment Office (NTFSO) shipment registers, the estimated total of 327 kt exported for energy recovery in 2017 (including EWC codes 20 03 01, 19 12 12 and 19 12 10) can be resolved into contributions by exporting company.

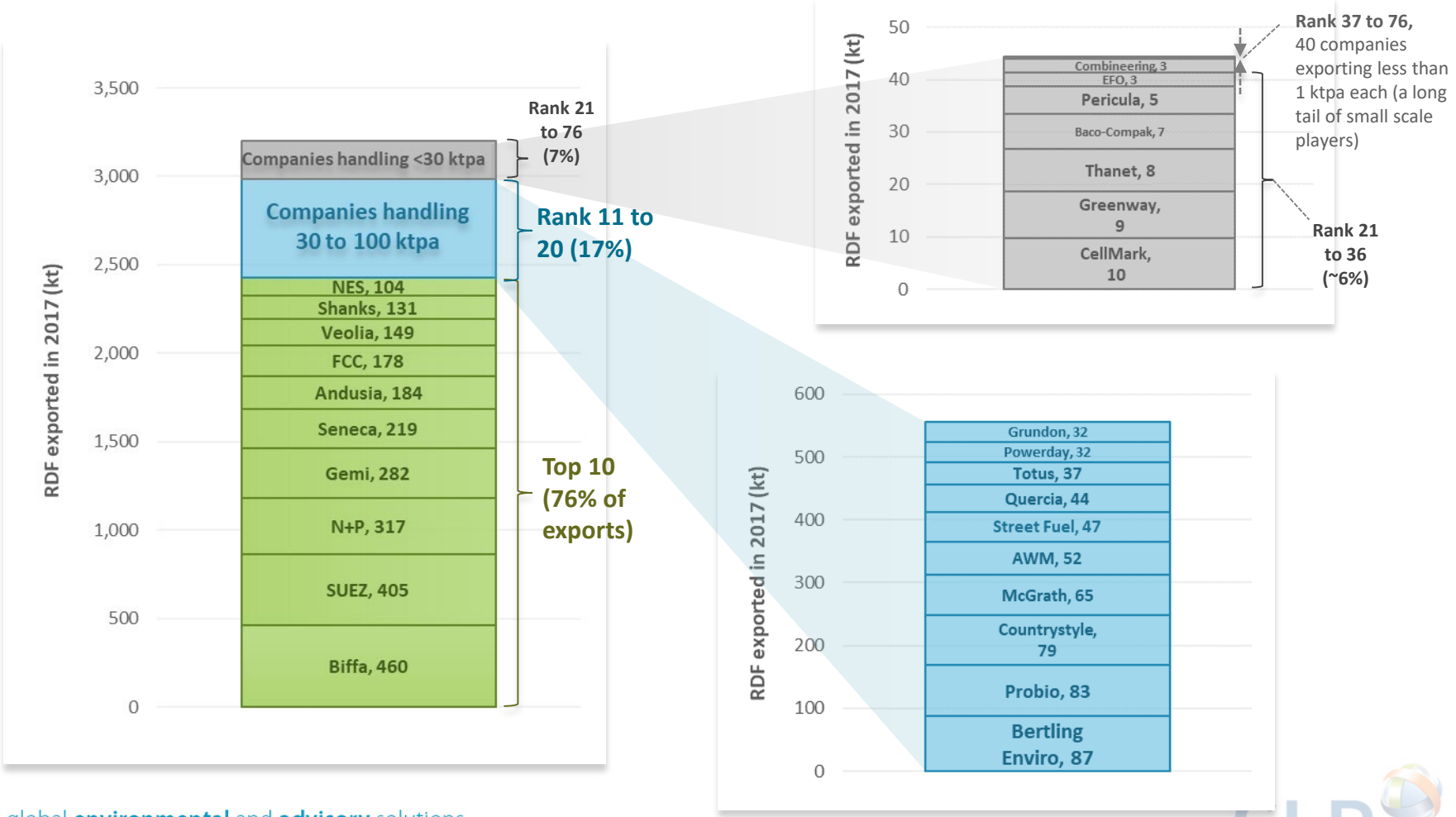


- Notably, in 2017, five key companies were responsible for 92% of total RDF exports.
- The remaining 8% of the export tonnage is then divided among 5 smaller market players.

3. WHAT DOES THE MARKET CURRENTLY LOOK LIKE?

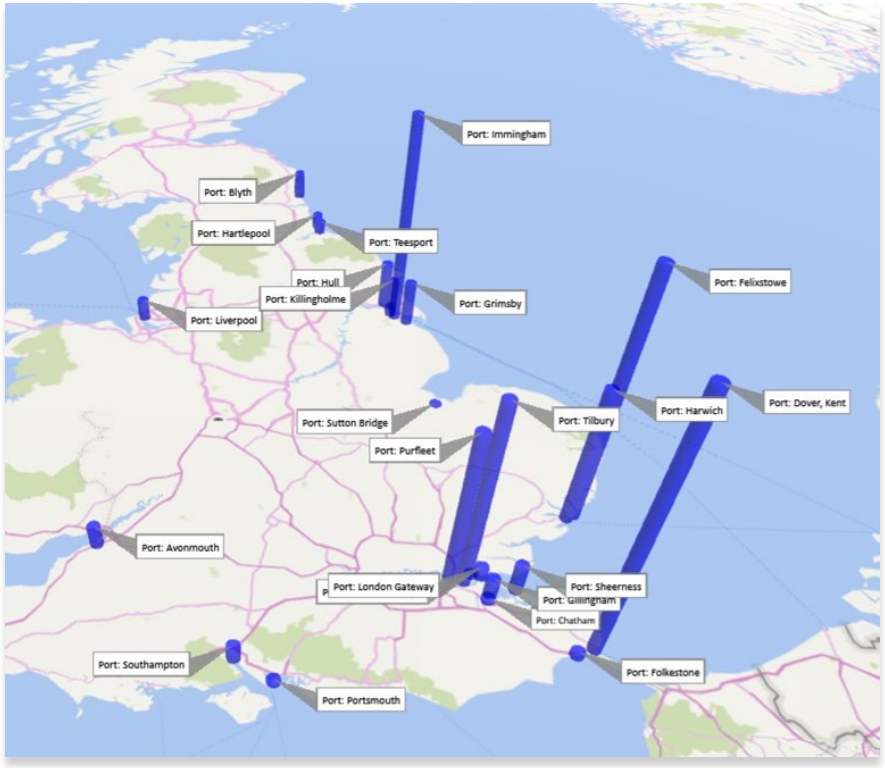
3.1 Exporting Companies (England)

- Within the UK, detailed RDF export data by exporting company is released by the Environment Agency for England. The breakdown of the total 3.2 Mt exported in 2017 by market player is illustrated below:

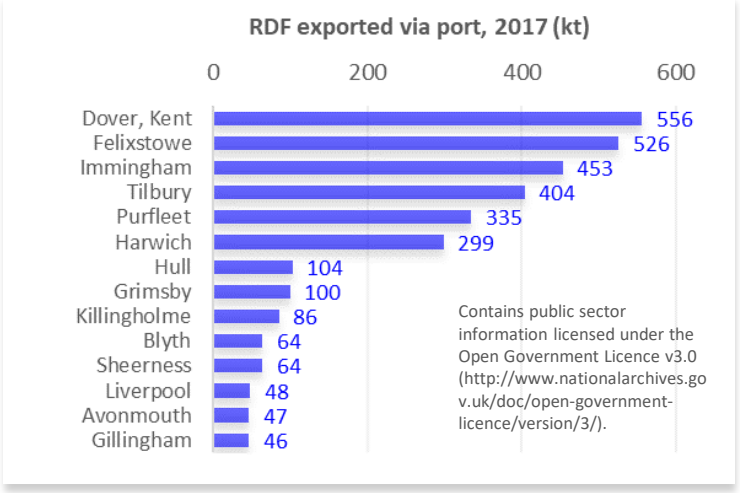


3. WHAT DOES THE MARKET CURRENTLY LOOK LIKE?
3.2 Ports Used (England only)

- Data made available by the Environment Agency (for the specific case of England) allows visualisation of RDF export tonnages by port.



(Please note that equivalent datasets are not currently available for the Republic of Ireland, Northern Ireland, Scotland or Wales.)



- Notably, the majority of RDF exported from England departs via ports on the east coast.
- These findings, combined with analysis of Environment Agency Waste Data Interrogator records, indicate that eastern regions have a proportionally much greater reliance on RDF exports – waste operators in these areas will therefore be most vulnerable to any market changes.
- While similar export port data is not available for the Republic of Ireland, it is understood that significant RDF export routes include the ports of Cork, Limerick, Waterford, Galway and Drogheda.

3. WHAT DOES THE MARKET CURRENTLY LOOK LIKE?
3.3 Destinations (Republic of Ireland)

- Analysis of NTFSO shipment registers shows that the main recipients of residual waste and RDF exported from the Republic of Ireland have been the Netherlands, Germany and Sweden.
- These countries have consistently ranked as the top three export destinations for the Republic of Ireland, though relative amounts received at each country have varied year on year.

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3. WHAT DOES THE MARKET CURRENTLY LOOK LIKE?
3.3 Destinations (England)

- Mirroring the case of Republic of Ireland, the main recipients of treated residual waste and RDF exported from England have been the Netherlands, Germany and Sweden.
- These countries have consistently ranked as the main export destinations, though relative amounts received at each country have varied year on year.

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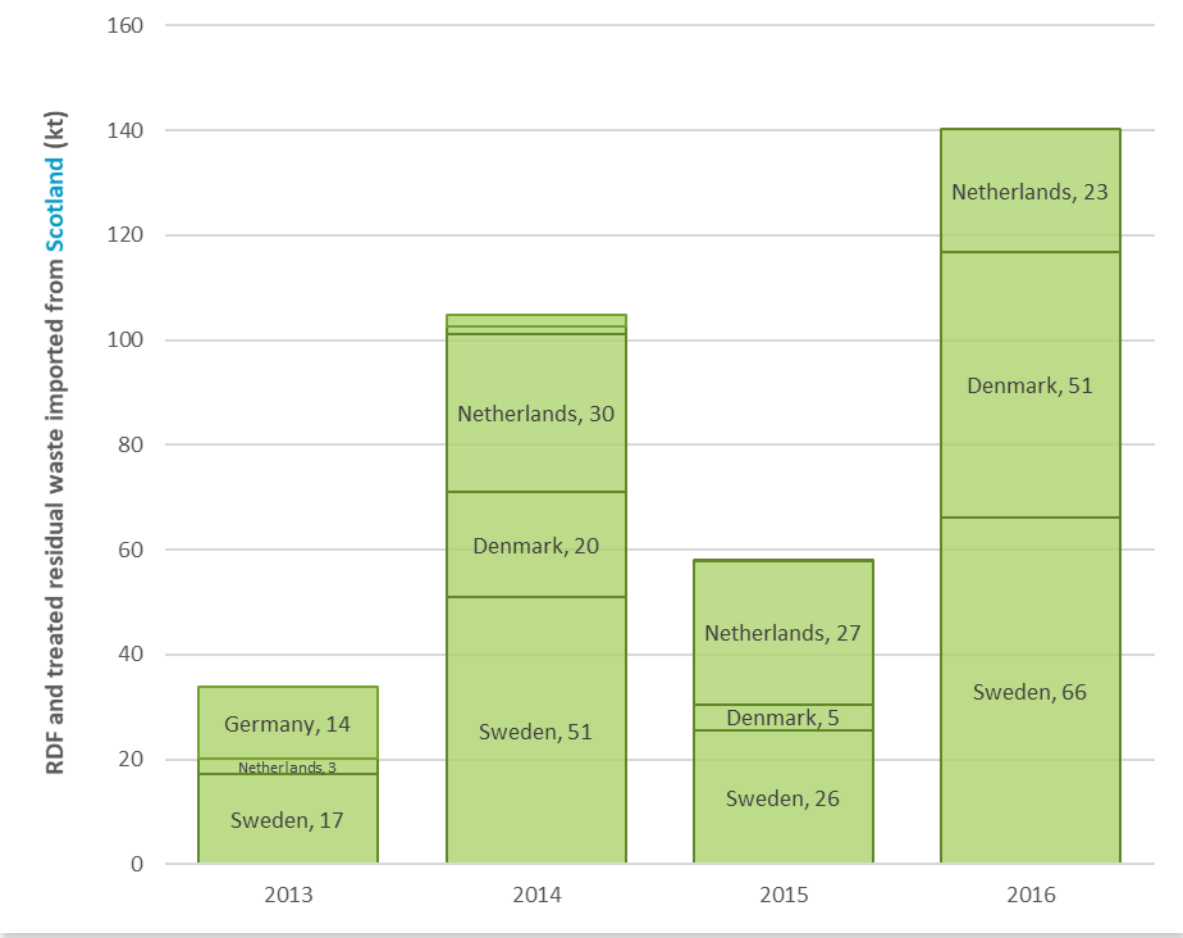
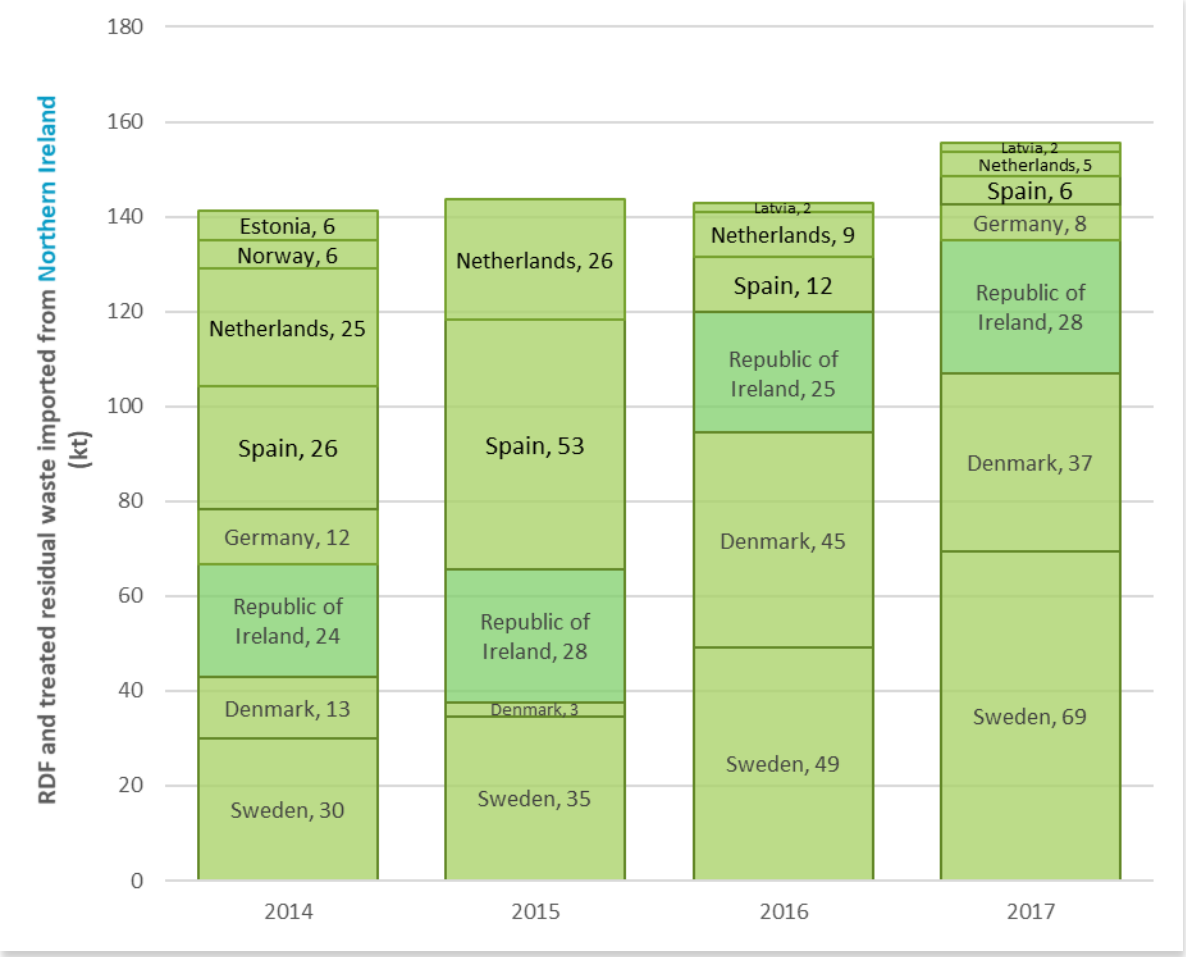
3. WHAT DOES THE MARKET CURRENTLY LOOK LIKE?
3.3 Destinations (Scotland)



- RDF export data provided by SEPA shows that – as per the Republic of Ireland and England, the Netherlands and Sweden feature within the top three export destinations.
- Germany is, however, absent from the top three, being replaced by Denmark.
- With relatively low RDF quantities currently exported annually from Scotland, tonnages fluctuate significantly year on year, being sensitive to changes to individual contracts.

3. WHAT DOES THE MARKET CURRENTLY LOOK LIKE?
3.3 Destinations (Northern Ireland)

- DAERA data on RDF exports shows a relatively stable export tonnage of 140 to 160 ktpa between 2014 and 2016.
- Paralleling the case of Scotland, Denmark and Sweden currently rank as the top two export destinations by volume.
- Notably, the Republic of Ireland is consistently a major recipient of material exported from Northern Ireland, ranking third in 2017 with 28 kt received (it is understood that this is largely SRF used at a cement kiln).



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3. WHAT DOES THE MARKET CURRENTLY LOOK LIKE?
3.4 End Users and Specifications

- In broad terms, end users of exported RDF fall into two key categories:

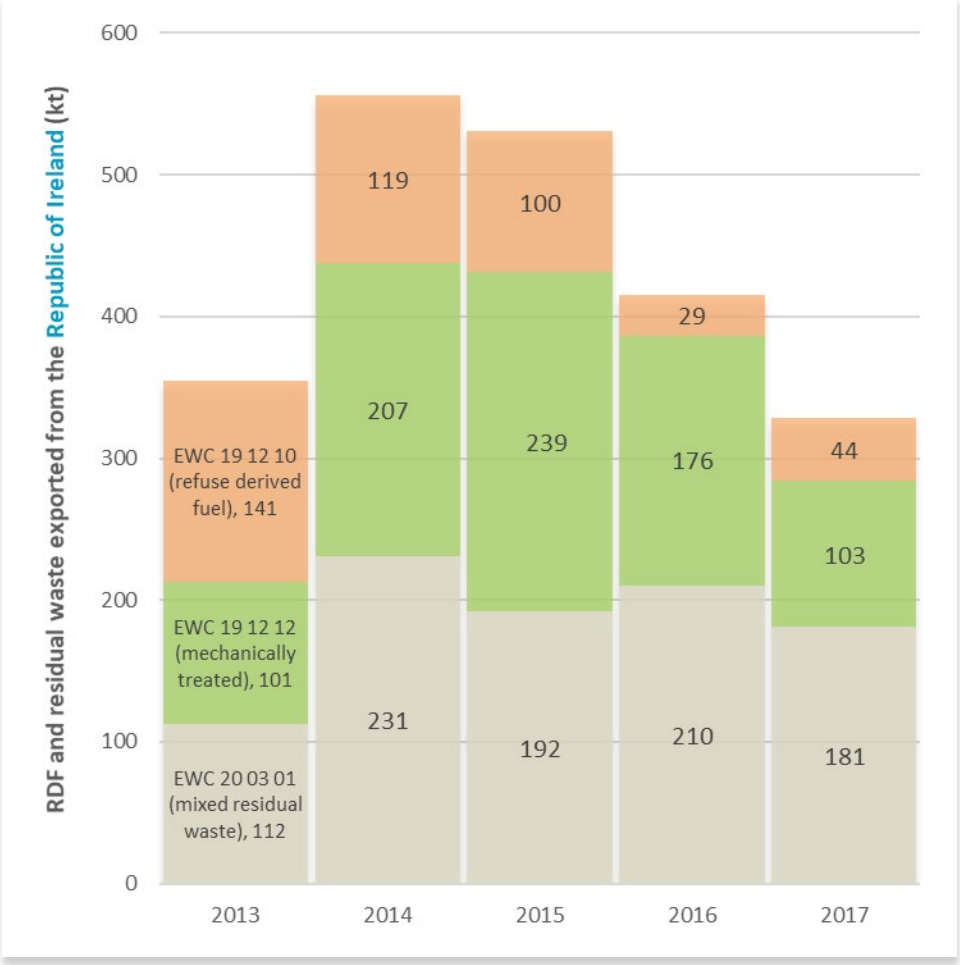
End user	Specification requirements:
Energy from waste (either producing combined heat and electrical power, or power only).	Dominated by conventional mass burn incineration*, energy from waste users are generally capable of accepting: • **raw untreated mixed residual waste** sourced from households and businesses; as well as • **basic RDF** produced from mixed residual waste through relatively simple processes (for example shredding, removal of ferrous/non-ferrous metals, baling). Process design typically allows for net calorific values in the range **9 to 12 MJ/kg**. Since the input to incinerators is ultimately limited by thermal capacity, at lower net calorific value, a greater quantity of waste can be processed – hence there is often a preference for lower net calorific value feedstock to maximise tonnage throughputs and thereby gate fee income.
Cement kilns (in which high specification RDF is substituted for fossil fuel heat sources).	Higher specification material destined for cement kiln end users is typically **solid recovered fuel (SRF)**, as opposed to RDF (though variations exist in the use of this terminology). In presenting data in this report 'RDF' is used as a catch all term for all exported material, SRF then being a subset of this total. Waste feedstocks used at cement kilns typically require a higher net calorific value. Cement kiln requirements vary significantly by process/facility, with reported specifications **ranging from as low as 13 MJ/kg to over 20 MJ/kg** in some cases. Further to net calorific value requirements, cement kiln end users may have other specification requirements, including limits on chlorine and heavy metal content including mercury, cadmium and thallium.

* (While a number of gasification facilities are currently in commissioning/construction in the UK, it is understood that few, if any, European gasification facilities currently accept exported RDF.)

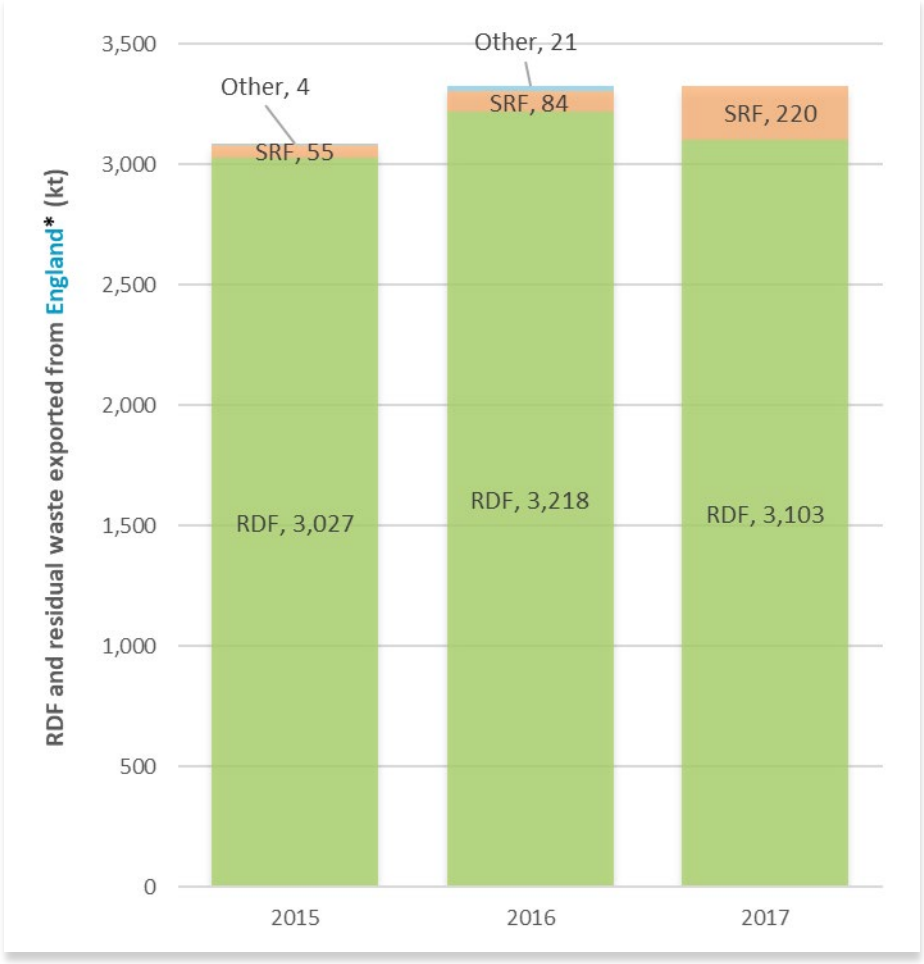
3. WHAT DOES THE MARKET CURRENTLY LOOK LIKE?

3.4 End Users and Specifications (Republic of Ireland) *(continued)*

- NTFSO shipment register data differentiates exports by EWC code, including contributions from:
  - EWC 20 03 01 (mixed residual waste, expected to generally have a relatively low net calorific value).
  - EWC 19 12 12 (mechanically treated residual waste, net calorific value potentially higher than the case of 20 03 01).
  - EWC 19 12 10 (refuse derived fuel, meeting treatment requirements stipulated by the EPA – likely to generally have the highest net calorific value of the three recorded codes).
- Reported tonnages exported from the Republic of Ireland under these codes are summarised opposite.
- In 2017, export of mixed residual waste coded EWC 20 03 01 dominated exports, amounting to 181 kt, or 55% of the total export.
- Reported export of 19 12 10 (more intensively processed RDF) stood at 44 kt, or 13% of exports in 2017. NTFSO data does not allow estimation of the proportion of exports which may qualify as SRF – however, this is understood to be low, due to high domestic demand for this material.



3. WHAT DOES THE MARKET CURRENTLY LOOK LIKE?
3.4 End Users and Specifications (United Kingdom)

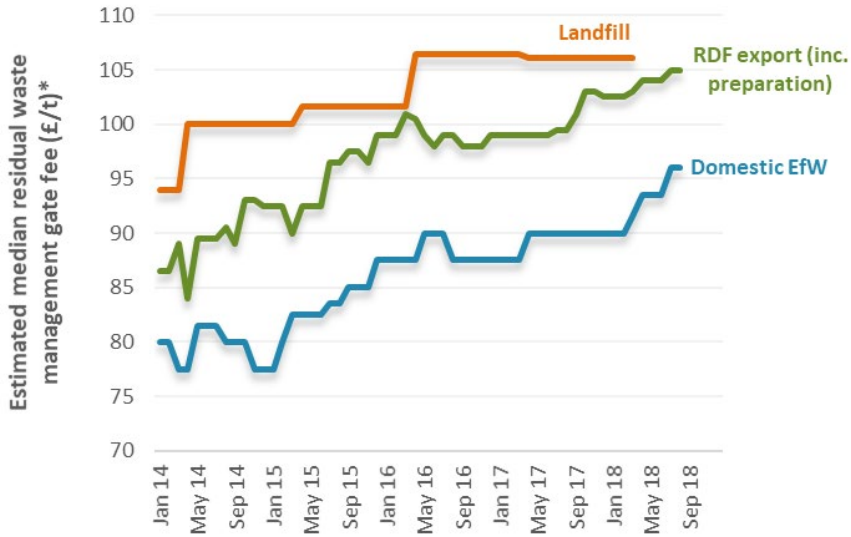


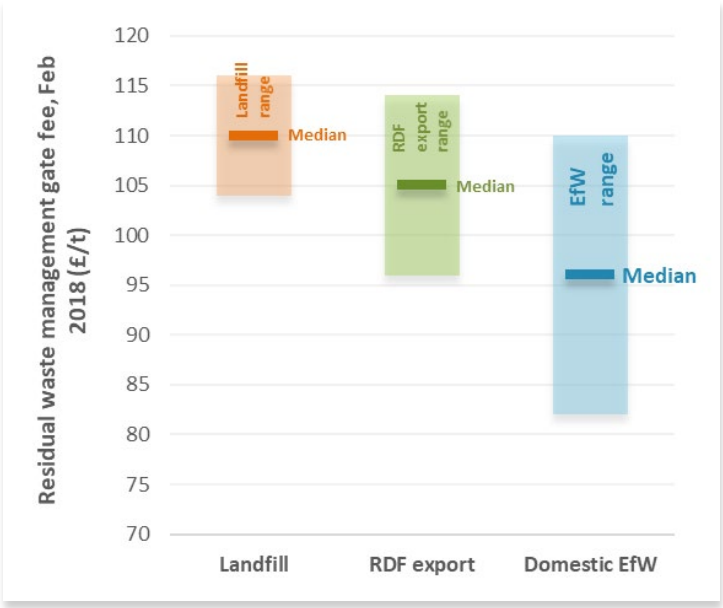
- English market data, sourced from the Environment Agency under Freedom of Information and summarised opposite, differentiates exports recorded as RDF and SRF.
- While the definitions used by operators in assigning materials to these categories are not disclosed, this dataset provides an indication of the overall segmentation of the market.
- While SRF represents a relatively small proportion of the total export from England (7% in 2017), it is notable that this proportion has risen over time.
- Similarly, in Scotland, of the total 140 kt of recorded RDF exports in 2016, 10 kt, or 7%, was classified specifically as SRF.
- For the case of Wales and Northern Ireland, all reported exports were recorded under the RDF specific EWC code 19 12 10, no data being available on what may qualify as SRF.

* Please note that some discrepancies exist between annual RDF tonnages indicated by Environment Agency Freedom of Information data, and published datasets. These discrepancies may be due to delays in reporting of exported tonnages.

3. WHAT DOES THE MARKET CURRENTLY LOOK LIKE?
3.5 Comparative Pricing

- As illustrated in section 2, rises in the Republic of Ireland's landfill levy and UK landfill tax have been critical in establishing RDF export as a cost effective waste management option.
- Estimated median historical time series (drawing on letsrecycle.com data) are illustrated right.
- Notably, focussing on the median case, RDF export is consistently cheaper than landfill, while domestic EfW is generally the lowest price option.





- While median prices are clearly stratified, full ranges in market price for these management options, included left, show a significant overlap (e.g. dependent on geographical location and contract opportunities available), landfill may remain the most cost effective option in some cases.
- Notably, letsrecycle.com cost estimates for RDF are consistent with SLR's recent market experience, which indicates all-in preparation and export costs of around £100/t.
- Anecdotally, SLR is aware of instances of EfW gate fees for contracted merchant commercial and industrial waste as low as £60/t.

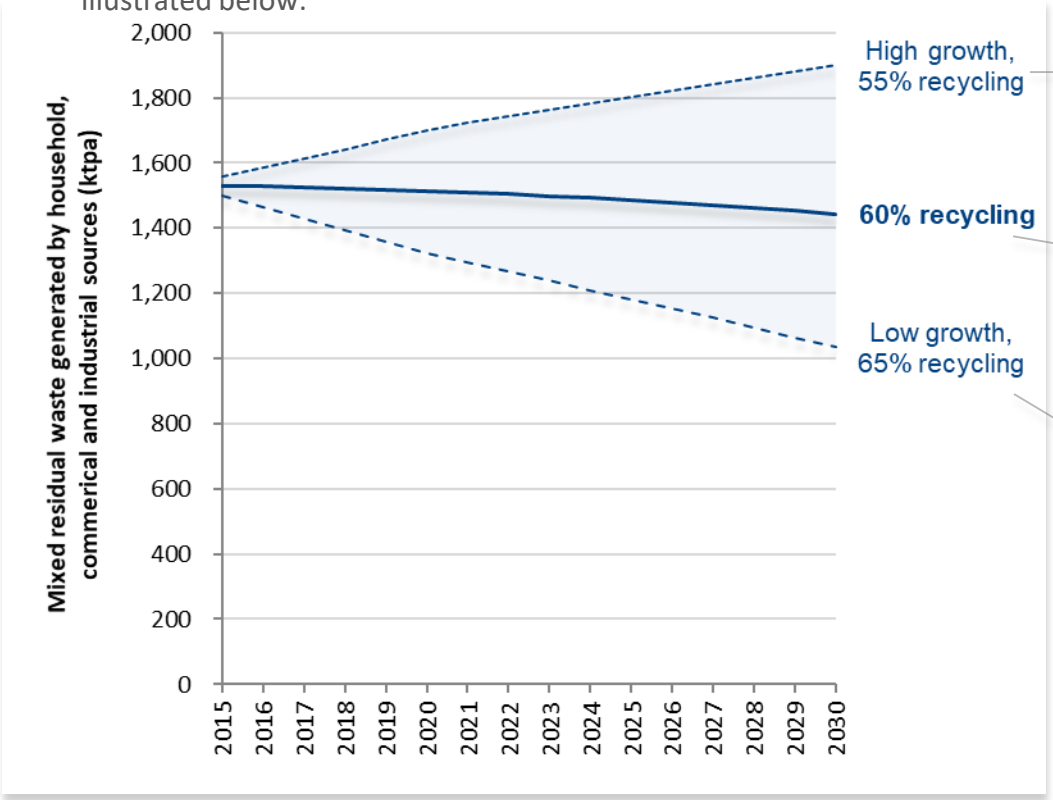
4. DOMESTIC RESIDUAL WASTE MASS BALANCE

- Findings on comparative pricing above indicate that production and export of RDF is typically more cost effective than landfill.
- However, in general, RDF production and export is likely to be more costly than gate fees paid at domestic EfWs (with some specific exceptions, and contingent on factors including the exchange rate as well as gate fees at European facilities).
- This being the case, the outlook for RDF exports is highly contingent on the domestic residual waste treatment capacity gap, being the balance between:
  - Supply of residual waste.
  - Demand for this material at domestic waste treatment facilities (largely energy from waste).
- To inform its consultancy work in the waste sector, SLR actively maintains in-house projection models for this supply-demand balance in the Republic of Ireland and the UK:
  - Generation of residual waste in each country is modelled as a function of population growth, and projected performance in source segregating materials for recycling.
  - Domestic residual waste treatment capacity is projected accounting for facilities which are operational, in construction, as well as prospective facilities. In accounting for domestic treatment capacity, separate consideration is given to:
    - Energy from waste facilities, including conventional incineration, as well as gasification; and
    - Net removal of residual waste from the market by RDF production facilities (for example in the form of recycling, losses, and inert rejects to landfill).
  - Deducting domestic treatment capacity from projected residual waste generation then indicates the future domestic residual treatment capacity gap – i.e. remaining material which will be managed via landfill or RDF export.

4. DOMESTIC RESIDUAL WASTE MASS BALANCE

4.1 Republic of Ireland

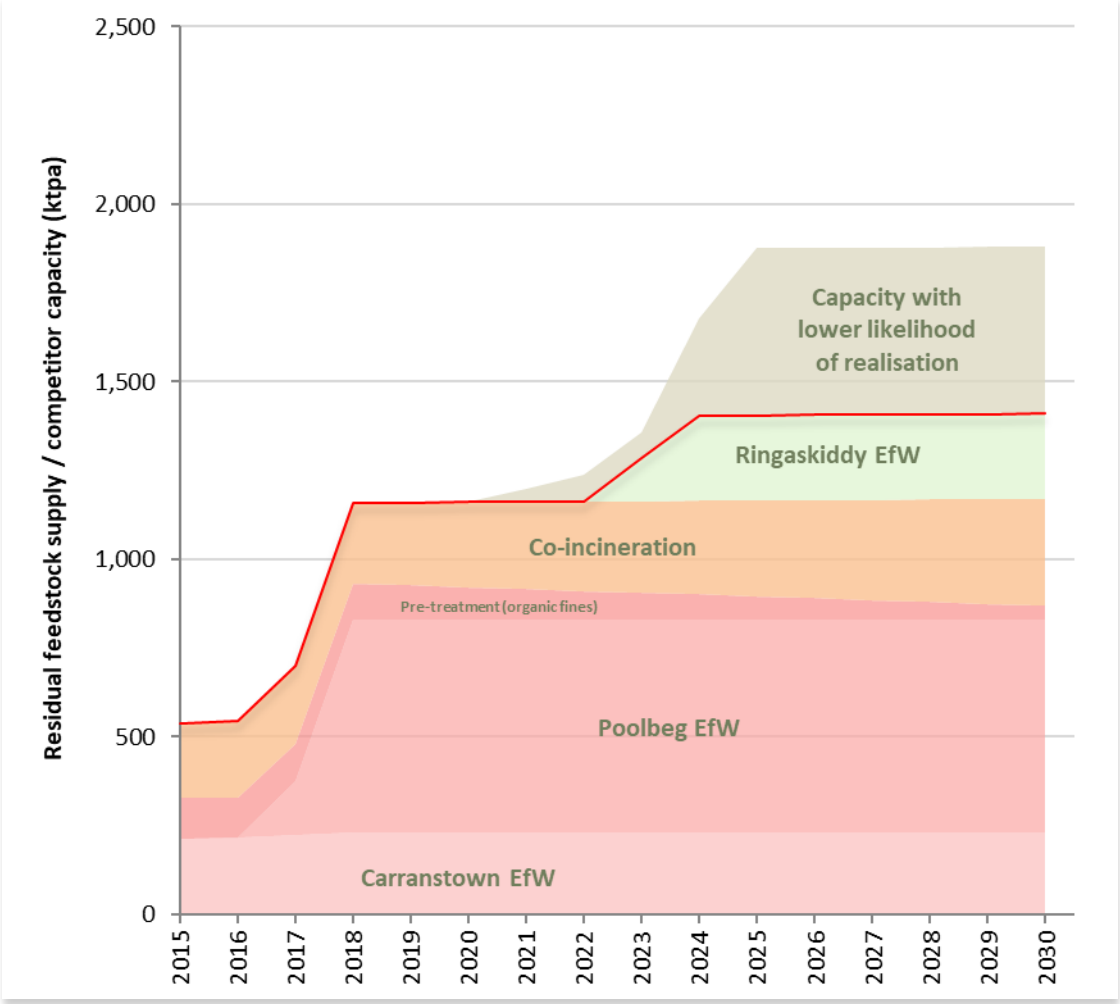
- The first step in determining the domestic waste treatment capacity gap in Republic of Ireland is to project arisings of mixed residual waste (i.e. ‘ black bag’ waste) in Republic of Ireland – inclusive of material produced by households, commerce and industry.
- Given uncertainties in future overall waste generation, and recycling rates attained, ultimate levels of residual waste generation cannot be projected definitively. Recognising this uncertainty, three contrasting modelled scenarios are illustrated below:



- Assumed high growth in overall arisings, combined with a low recycling case in which the 2030 recycling rate falls short of the EU CEP 60% target by 5%.
- Intermediate growth in arisings, with recycling achieving EU targets (50% recycled by 2020 in compliance with the existing Waste Framework Directive, rising to 60% by 2030.
- Low growth in arisings, combined with high recycling attainment, exceeding the original EU target to reach 65% recycling by 2030.

4. DOMESTIC RESIDUAL WASTE MASS BALANCE

4.1 Republic of Ireland *(continued …)*

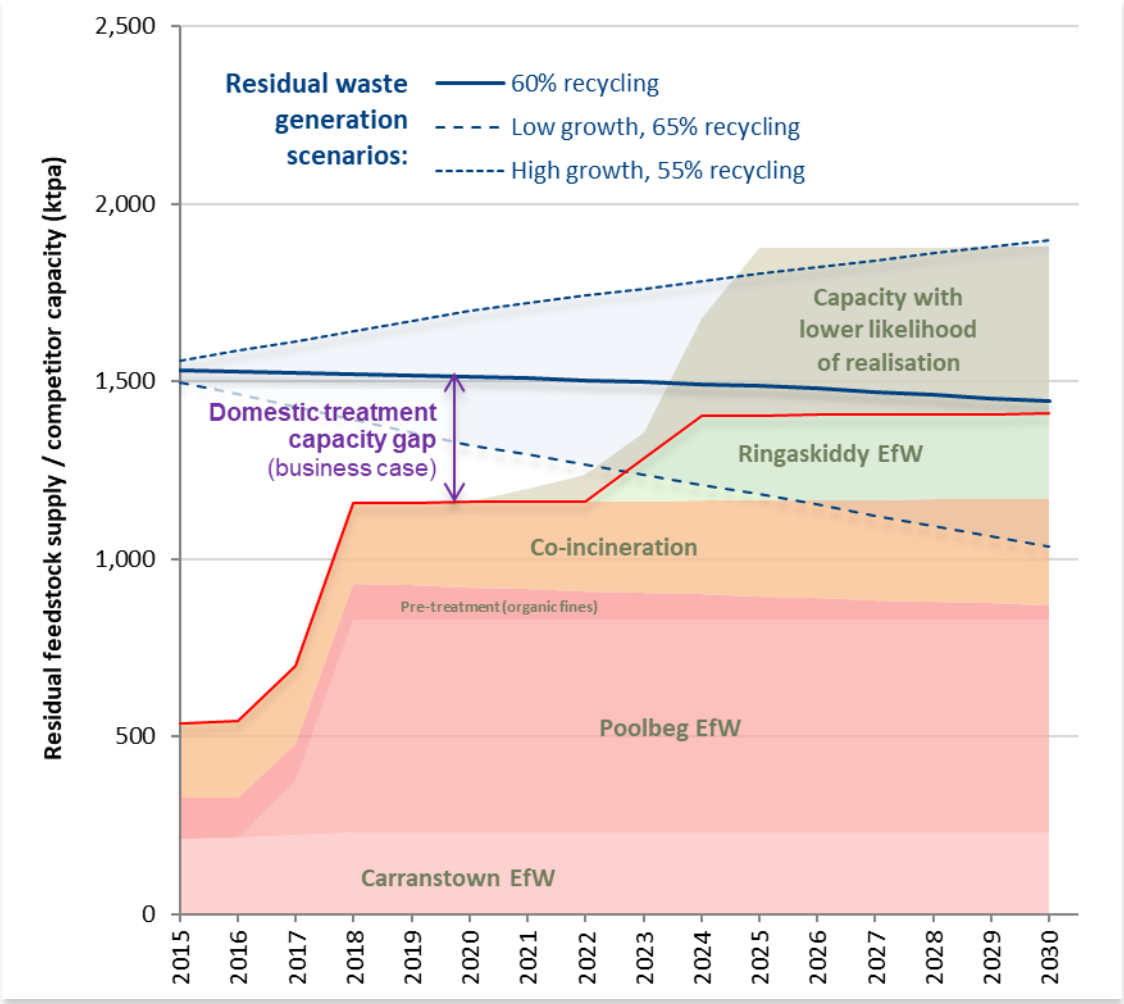


SLR's projection for capacity available in Republic of Ireland to treat forecasted residual waste arisings is illustrated opposite. Key contributions include the following:

- The existing EfW facility at Carranstown, Co. Meath, with a capacity of 230 ktpa.
- Covanta's 600 ktpa EfW at Poolbeg, commissioned in 2017.
- Pre-treatment of organic fines at mechanical biological facilities.
- Co-incineration – referring to the use of residual waste in the form of SRF at cement kilns within Republic of Ireland.
- The recent planning permission award to Indaver for development of an EfW at Ringaskiddy with capacity to process 240 ktpa MSW.
- Capacity of range of further proposed facilities, considered to have a low likelihood of realisation, amounting to circa 1,200 ktpa.

4. DOMESTIC RESIDUAL WASTE MASS BALANCE

4.1 Republic of Ireland *(continued …)*

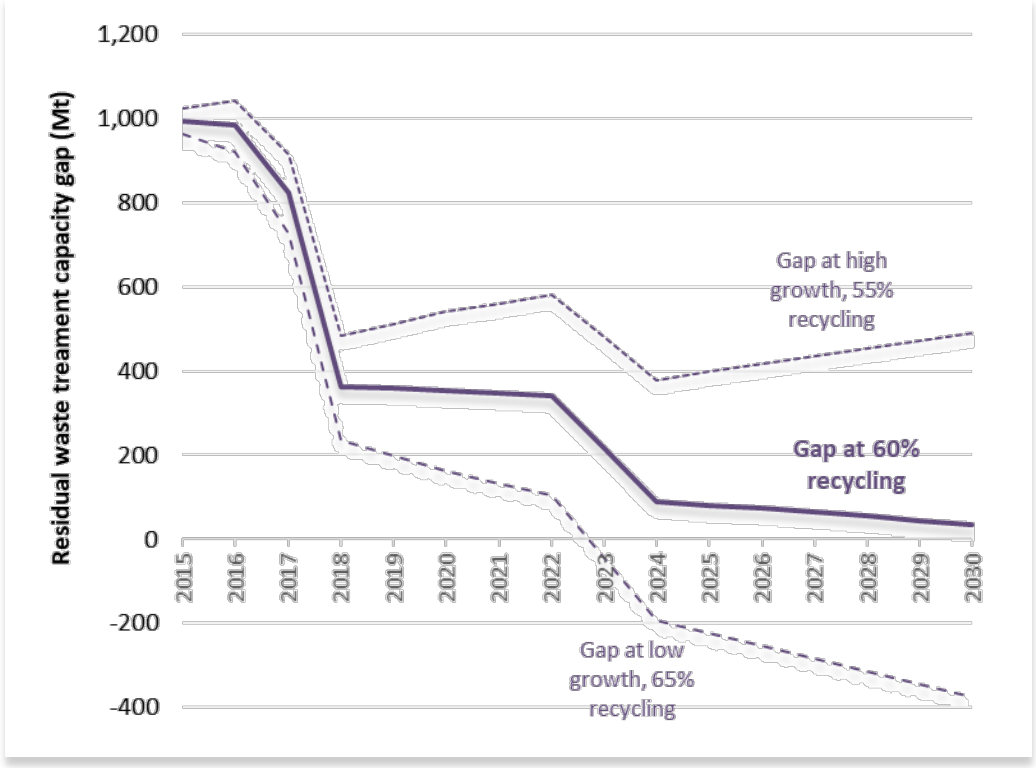


- As illustrated, the business case capacity gap is taken as:
  - the projected business case feedstock arising (solid blue line);
  - less competitor capacity (solid red line), exclusive of RDF exports, and low / very low likelihood competitors.
- Notably, taking the 'target compliance' scenario (60% recycling by 2030 as per the EU CEP), the residual waste arising comes into close balance with treatment capacity by 2030.
- The projected capacity gap (calculated as the residual waste arising, less projected treatment capacity, as indicated by the arrow in the previous slide above) is illustrated overleaf.

4. DOMESTIC RESIDUAL WASTE MASS BALANCE

4.1 Republic of Ireland *(continued …)*

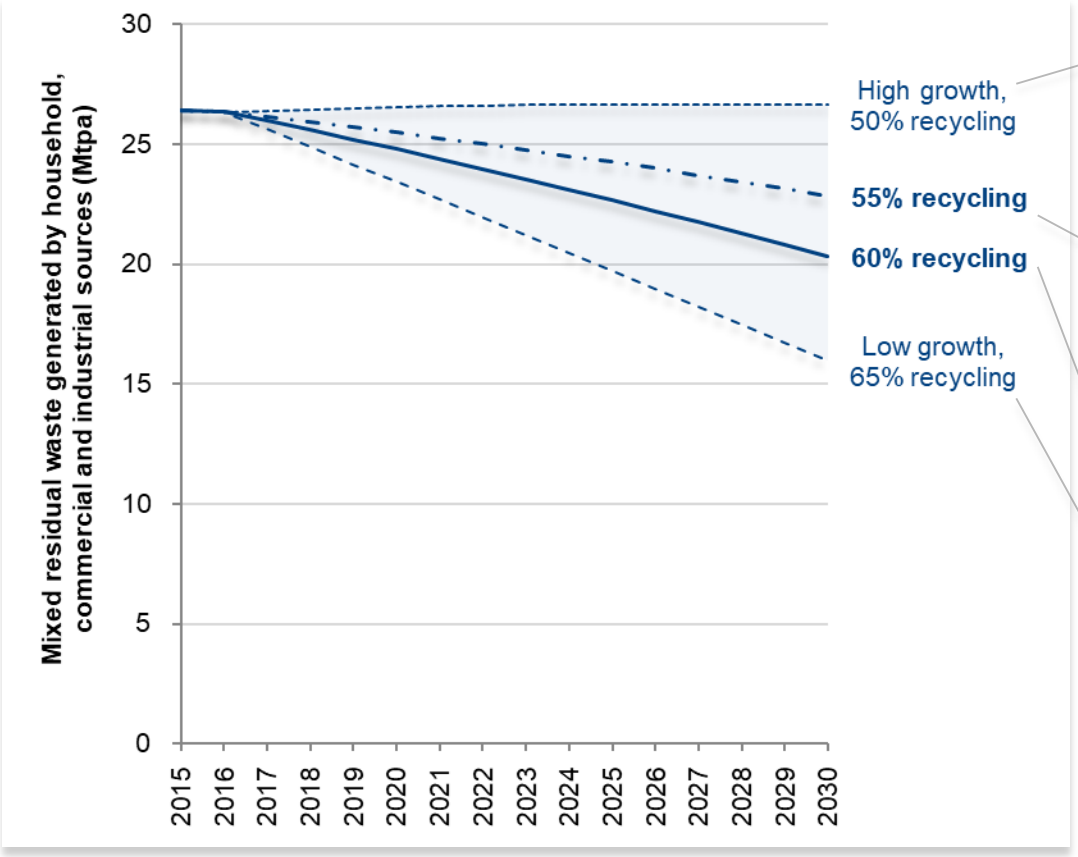
- Here contrasting lower (dashed purple line), central (solid line) and upper (dotted line) capacity gap scenarios are derived, dependent on projected residual waste arising in the Republic of Ireland in 2030.



- Assuming compliance with the EU CEP target for 60% recycling, and accounting for projected treatment capacity, the residual waste capacity gap effectively falls to zero by 2030.
- However as shown by the modelled upper and lower cases, this outcome is highly contingent on levels of waste generation and recycling rates achieved.
- A further sensitivity not considered here is the rate of build out of new capacity – for example development of a further major EfW in Republic of Ireland could potentially displace exports even earlier.

4. DOMESTIC RESIDUAL WASTE MASS BALANCE
4.2 United Kingdom

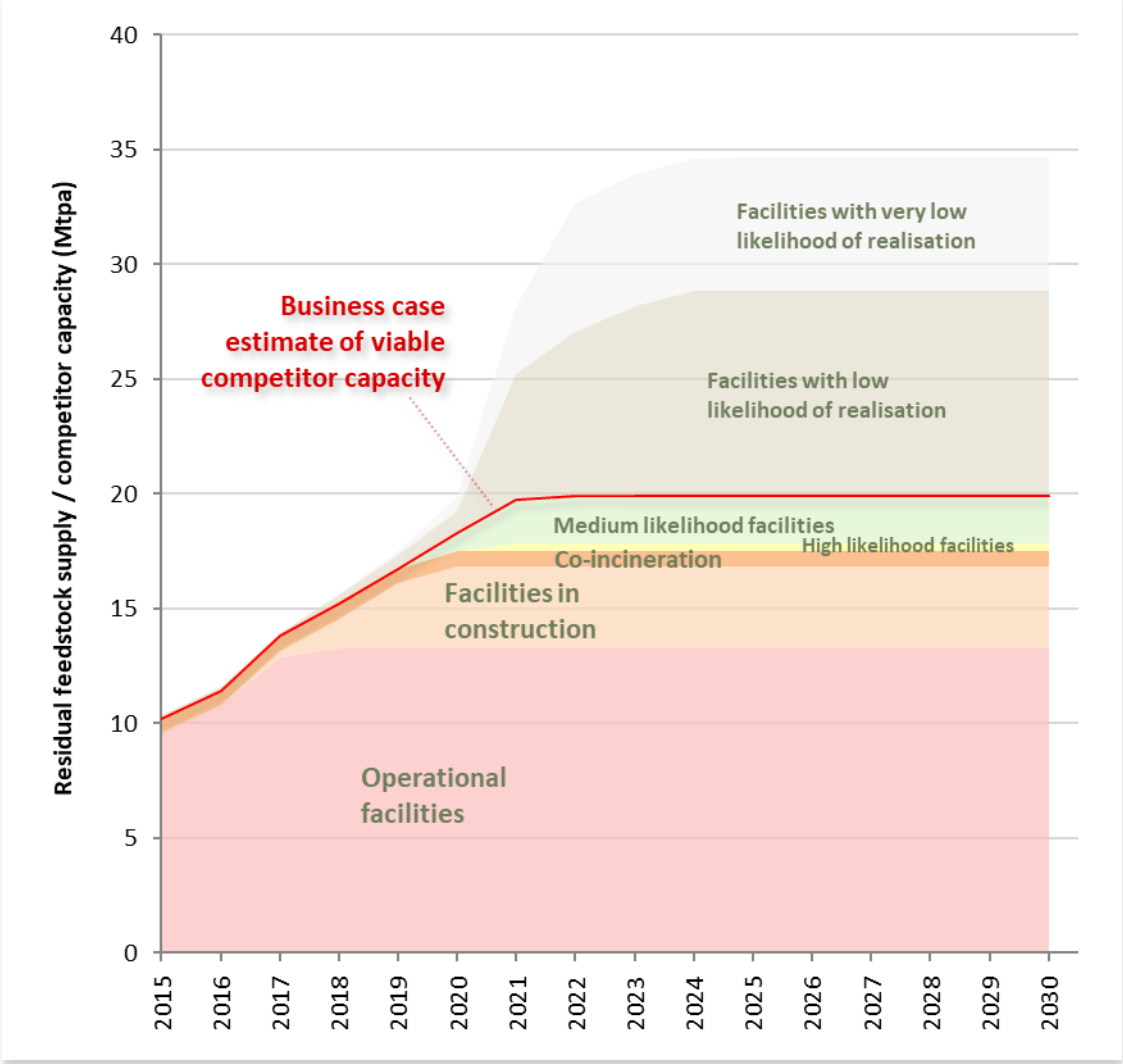
- Following an identical approach to that outlined above for the case of the Republic of Ireland, SLR has projected the future residual waste supply/demand balance in the UK.
- Forecasts for residual waste arising in the UK (again inclusive of material generated by household, commercial and industrial sources) are illustrated below, under varying scenarios for waste generation and recycling.



- High growth in waste arisings, combined with low recycling, ultimately achieving the Waste Framework Directive target for 50% household waste recycling by 2030.
- 2030 recycling falling short of the EU CEP target for 60% by 5% (arguably the most likely case given uncertainties around Brexit and lack of UK policy direction).
- Achievement of the EU CEP 2030 target.
- Low growth, with the EU CEP exceeded by 5%.

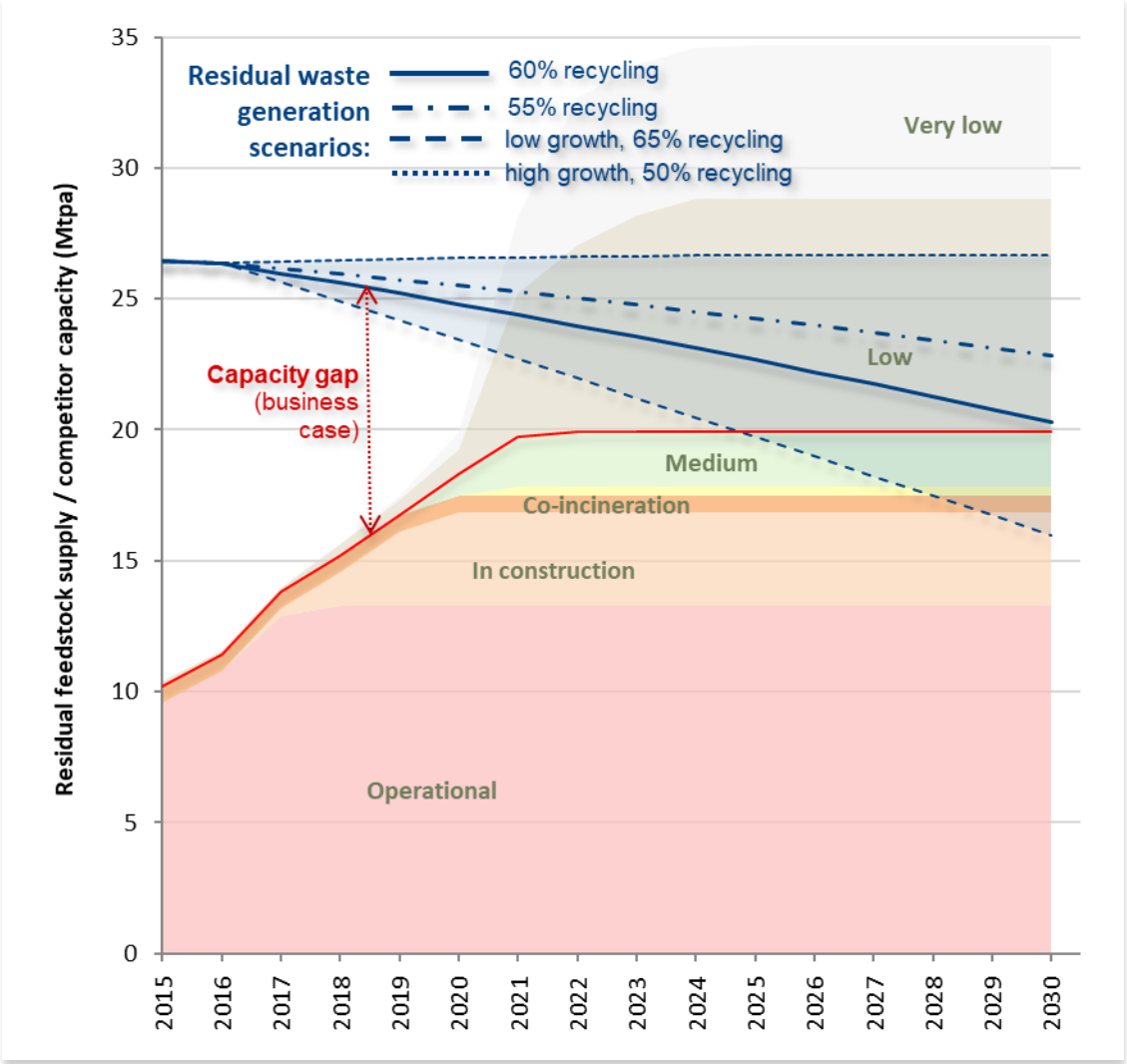
4. DOMESTIC RESIDUAL WASTE MASS BALANCE

4.2 United Kingdom *(continued …)*

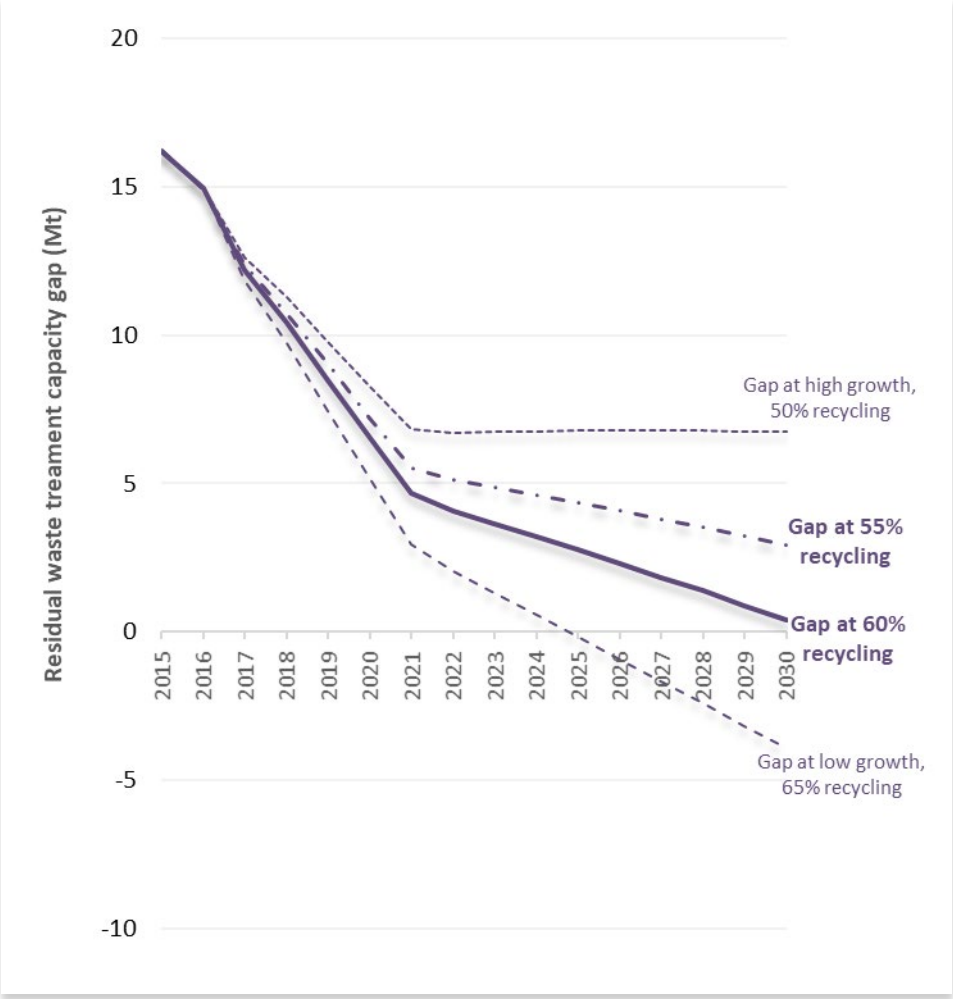


- In the UK, around 150 residual treatment facilities are operational or in construction, with over 130 in planning or proposed. SLR tracks the development of these facilities via an in-house database.
- Facilities considered include pre-treatment facilities (e.g. mechanical biological treatment), and energy from waste (including incineration and gasification).
- Here the combined capacity of facilities is aggregated by status, including facilities which are operational or in construction, as well as prospective plants those yet to be developed.
- Prospective facilities are attributed a likelihood of realisation (high, medium through to very low) according to published details of their status (for example planning, investment, feedstock contracts).

4.2 United Kingdom *(continued …)*



- As per the case of the Republic of Ireland, forecasted residual waste supply can be overlaid against estimated treatment facility requirements to indicate the future supply / demand balance.
- For the purpose of modelling the capacity gap, facilities considered to have low or very low likelihood of realisation are assumed not to proceed.
- Capacity of facilities considered to have high or medium likelihood of development are included as part of the capacity gap calculation.



- Paralleling the case of the Republic of Ireland, contrasting capacity gap scenarios can be derived for each feedstock projection case.
- Assuming that domestic EfW generally offers a lower disposal price than RDF export (as indicated above), the quantity of RDF exported will be largely limited by the capacity gap.
- Under the central scenario, from 2026 onwards the capacity gap will begin to constrain the level of RDF exports – that is, setting aside any effects due to changing European demand (explored further in section 5) the central case indicates a long term decline in exports.
- This finding is, however, highly sensitive to UK residual waste generation. For example, under the residual case (high waste generation per person, low recycling) the capacity gap remains long term, such that exports continue to be unconstrained by domestic supply.

5. WHAT WILL SHAPE FUTURE MARKET DEMAND?

- Section 4 above considers the domestic mass balance in the Republic of Ireland and UK, indicating the potential long term treatment capacity gap. This capacity gap ultimately represents the pool of feedstock in these countries which may be available as supply for RDF export.
- Complementing these supply side findings, slides below consider factors which may potentially influence market demand, including:
  - Possible impacts of Brexit.
  - Future EU RDF need and international pull.
  - Quality standards.
  - The Chinese National Sword programme.
- Consideration is then given to the ways in which these factors could combine to influence the development of the RDF market.

5. WHAT WILL SHAPE FUTURE MARKET DEMAND?

5.1 Brexit

- Given that the long term outcome of Brexit negotiations remains unpredictable, it is not possible to comment definitively on how RDF exports from the UK might be impacted post-Brexit. However, two key issues have been raised in the sector as concerns in the context of Brexit:
  - Imposition of tariffs on RDF imports.
  - Increased friction to RDF movements due to the imposition of customs controls.
- **Tariffs**: In the document 'Waste Export: Brexit Briefing Note' (June 2018), the RDF Industry Group cite the need to ensure that a trade deal is reached with the EU and European Environment Agency (EEA) which provides for a 0% tariff on RDF export. However, the Group also references an EU regulation defining reliefs from customs duty (specifically EC No 1186/2009), which states that:

  "any consignments made up of goods of negligible value dispatched direct from a third country to a consignee in the Community shall be admitted free of import duties"

  where negligible value means goods ***"the intrinsic value of which does not exceed a total of EUR 150 per consignment."***
- In addition, during a stakeholder briefing in August, Defra stated that:

  "Our view is that the export of waste for recovery does not constitute a sale of goods but the provision of a service. This is based on our understanding that UK exporters of RDF/SRF have to pay the energy recovery sites to take UK RDF/SRF away.

  "This view is supported by both HMRC and the WTO (which considers Refuse Disposal generally a service). As a result, no tariff should be applied to the export."
- **Customs controls:** While the imposition of tariffs appears unlikely, a further potential impediment to RDF export flows is 'friction' due to customs controls and border delays.

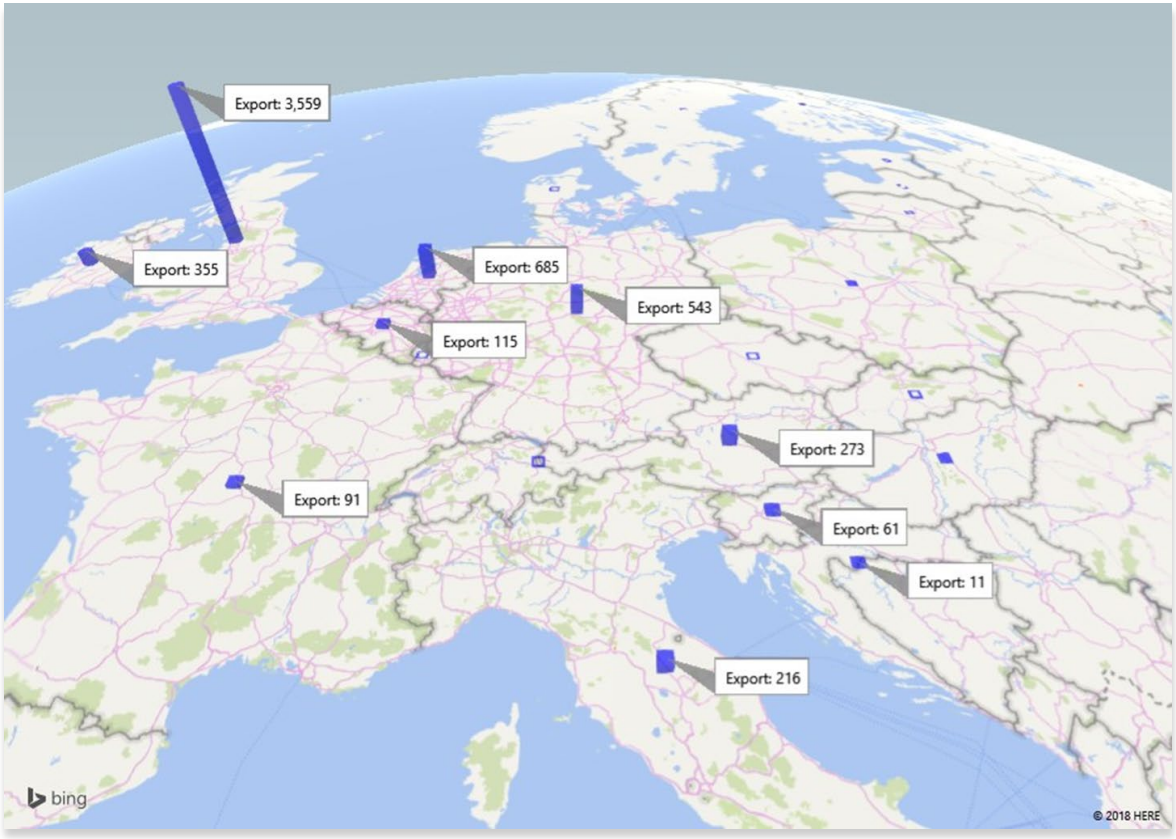
5. WHAT WILL SHAPE FUTURE MARKET DEMAND?

5.1 Brexit

- At the time of writing, customs arrangements still remain a critical point of contention in Brexit negotiations:
  - In July 2018, Parliament voted to reject continuing membership of the EU Customs Union (EUCU) post-Brexit.
  - Default customs measures, if the UK is outside the EUCU, will include requirements for customs declarations, as well as checks on imported goods.
  - While the UK Government maintains that post-Brexit trade with the EU should remain as frictionless as possible, it remains unclear how this will be achieved in practice.
- Any increase in friction to RDF movements due to customs requirements could impact on the economics of RDF export through prolonged transit times, additional administrative requirements. In the event that new customs arrangements cause a major obstruction to imports, the result could be increased stockpiling of RDF and possible feedstock deterioration, penalties for delays under 'Put or Pay' contracts and currency fluctuations, given that the majority of contracts are in euros. Any significant stockpiling resulting from border disruption could also result in regulatory breaches and increased waste crime.
- The issue of customs controls outside the EUCU clearly impacts on ongoing movements of RDF over the border between the Republic of Ireland and Northern Ireland.
  - As identified above in section 3, in 2017, 28 kt of RDF/SRF was exported from Northern Ireland to the Republic of Ireland (however, recorded 2017 flows from the Republic of Ireland to Northern Ireland were negligible at less than 400 tonnes).
  - At present, the post-Brexit customs approach for movement of goods across the Irish border remains unresolved.
  - If developers are not successful in realising domestic EfW capacity in Northern Ireland, in the event that RDF export is severely disrupted, Northern Irish councils and waste management companies may have to return to greater reliance on landfill.

5.2 EU and Other International Demand

- This section considers the issue of potential future demand – in Europe and elsewhere – for RDF arising in the Republic of Ireland and UK.



- Current RDF exports can be assessed through analysis of export data compiled by Eurostat – presented opposite.
- With a combined export of 3.9 million tonnes in 2016, the Republic of Ireland and the UK dominate EU exports (66% of the 5.9 Mt total exported from European countries).
- In 2016, imports from the UK amounted to 86% of total imports to the Netherlands, 64% of imports to Sweden, and 48% of imports to Germany.

5. WHAT WILL SHAPE FUTURE MARKET DEMAND?
5.2 EU and Other International Demand *(continued)*

- Critical to future RDF demand is the EfW capacity surplus which exists in recipient countries.
- Official sources do not quantify the EfW capacity surplus on a country by country basis.
- Indicatively, however, the gap in any given country may be inferred as the net import (i.e. import minus exports – the assumption being that all domestic EfW capacity is utilised).
- Net imports calculated on this basis are illustrated opposite.
- On this basis the Netherlands emerges as having the greatest estimated capacity surplus (1.3 Mt), followed by Germany and Sweden (both at circa 1.0 Mt).

- Future availability of capacity in these countries is therefore critical to ongoing exports from the Republic of Ireland and UK.

5. WHAT WILL SHAPE FUTURE MARKET DEMAND?
5.2 EU and Other International Demand *(continued)*

- Critical factors which will determine the future extent of capacity surpluses in Germany, Sweden and the Netherlands are summarised below:

	Factors affecting capacity gaps in major RDF receiving countries	Comments on impacts
Upward influence on gap ↑	Population growth in receiving countries	Tending to increase overall waste arisings, and thereby the arising of residual waste. Eurostat indicates modest growth of 4% in Germany by 2030, relative to 2015, with 15% and 9% growth respectively for Sweden and the Netherlands over the same period.
	Build out of new EfW capacity in receiving countries	While some build out of new capacity is anticipated, it is notable that its communication on the role of waste-to-energy in the circular economy, the EC explicitly states that 'Member States are advised to gradually phase-out public support for the recovery of energy from mixed waste'. It therefore appears that future European policy will begin to work against the development of new capacity.
↓ Downward influence on gap	Increase in recycling towards circular economy targets	Proposed EU CEP revisions to the Waste Framework Direct will require 55% municipal waste recycling by 2025, 60% by 2030 and 65% by 2035. Assuming progress in Germany, Sweden and the Netherlands towards these targets, a reduction in residual waste arisings is expected, widening capacity gaps.
	Decommissioning of existing EfW facilities	Limited published information exists on the proportion of EU plants which are approaching decommissioning. UK examples (Edmonton EfW in North London, Eastcroft EfW in Nottingham, and Coventry EfW) indicate that the working lifetime of existing facilities can be significantly extended.

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5. WHAT WILL SHAPE FUTURE MARKET DEMAND?

5.2 EU and Other International Demand *(continued)*

- The direction of change in the capacity surpluses of countries currently importing RDF will depend upon the balance of the above factors.
- Assuming that capacity gaps in Germany, Sweden and the Netherlands remain, a further factor potentially impacting on RDF exports from Republic of Ireland and UK is displacement by residual waste from other EU member states:
  - In addition to increases in recycling, the EU CEP also limits the proportion of residual municipal waste disposed to landfill to 10% by 2030.
  - Given this Circular Economy target for reduction in landfill, countries currently having a high dependence on landfill (in general southern and eastern European member states) may increasingly seek to utilise spare capacity in Germany, Sweden and the Netherlands.
  - The ability of other countries are to displace RDF imported from the Republic of Ireland and the UK will be contingent on a number of factors:
    - Ability to pay a gate fee competitive with that offered by exporters from the UK and Republic of Ireland.
    - Haulage costs – long range movement of RDF by road potentially being cost-prohibitive.
    - Specific to the UK, any impact of Brexit which tends to increase the cost of export to Europe (as detailed above).
  - Given uncertainties around these factors, it is not possible to meaningfully quantify the future extent to which RDF exported from the Republic of Ireland and UK may be displaced by supply from other countries.
  - Nevertheless, displacement of the Republic of Ireland and UK RDF exports by feedstock sourced from continental Europe remains a possibility in the long term.

5. WHAT WILL SHAPE FUTURE MARKET DEMAND?

5.2 EU and Other International Demand *(continued)*

- For the case of Germany, the future capacity gap may be impacted to some extent by recent legislation on the management of sewage sludge:
  - German policy is to phase out the direct use of sewage as a fertiliser on land.
  - The proportion of sewage sludge managed by incineration in Germany has risen dramatically in recent years, reaching a reported 65% in 2016 (1.1 Mt out of an estimated total arising of 1.8 Mt).
  - It is notable that new legislation favours recovery of phosphorous, with a prohibition on co-incineration of sludges containing more than 20 g of phosphorus per kg dry matter.
  - Landfill application will also continue to be permitted for smaller scale waste water treatment plants.
  - Further increases in management of sewage sludge via incineration could erode the German capacity gap – however given the above considerations, the impact on net RDF demand may be limited.
- Proponents of RDF exports from the UK have emphasised the positive aspects of the practice:
  - Benefits cited include:
    - Diversion of residual waste from UK landfills whilst domestic residual waste treatment capacity is built out;
    - Recovery of some recyclables (most notably ferrous and in some cases non-ferrous metals) by the RDF preparation process; and
    - Reduction in carbon emissions (many receiving EU EfW facilities operate in CHP mode, and therefore potentially have greater carbon benefits than their UK counterparts).
  - In assessing these benefits, it should be noted that from a wider European perspective, utilisation of excess EfW capacity by countries other than the Republic of Ireland and the UK would deliver the same positive outcomes.

  - The long term scenario in which the Republic of Ireland and the UK ultimately develop adequate domestic EfW facilities (CHP enabled wherever possible) – thereby freeing up capacity for other countries which have a greater reliance on landfill – is therefore arguably ultimately preferable in carbon terms.

- Some commentators have raised the possibility of the emergence of a market for export of RDF outside of the EU – Russia being cited as one example:
  - Eurostat data for 2014 indicates no significant movement of RDF (here taken to encompass EWC codes 19 12 10, 19 12 12, and 20 30 01) outside Europe.
  - To allow the development of viable RDF markets outside Europe, commercial conditions would have to exist in which supply from Europe would be favourable relative to domestic supply. These could for example include (but would not be limited to):
    - The existence of a capacity gap (for example as per Germany) in the receiving country.
    - The ability of exporters from the Republic of Ireland and UK to pay a gate fee which is higher than that received for RDF generated domestically within the country.
    - The existence of a specific requirement for a high specification SRF (most likely at a cement kilns) to displace fossil fuel based inputs (though this would require development of appropriate SRF preparation capacity in the Republic of Ireland and the UK.
  - It is currently unclear whether these requirements are met on any significant scale in countries outside the EU.

5. WHAT WILL SHAPE FUTURE MARKET DEMAND?

5.3 Quality Standards

- Current approaches to the definition and coding of RDF in the Republic of Ireland and the four UK administrations are outlined above in section 2.2 (Regulatory Approaches).
- While definitions vary between countries, it is understood that in general, quality requirements do not present a significant impediment to export of RDF – exports are understood to be dominated by low calorific value material derived from residual municipal waste by relatively basic processes.
- As noted in section 2.2, in February 2017, Defra introduced a definition of RDF, stipulating that to be classified as such, materials must be exchanged under a written contract with the end user, stating end user requirements for calorific value, moisture content and form. As such the Defra approach does not prescribe any quality standard – instead simply stating that RDF properties must be recorded in writing.
- While regulatory bodies could theoretically impose higher standards in future, there is currently little indication of any intention to move to a more prescriptive approach.
- There is however one notable development in the context of waste plastics:
  - Between March to May 2018, the Treasury ran a consultation on the use of the tax system to address single-use plastic waste.
  - At the closure of this consultation, the Exchequer Secretary commented that a tax on incineration was possible, stating that *"We would like to see less plastic incinerated, sent to landfill or exported and more recycled."*.
- However, the Budget 2018 stopped short of introducing a tax on incineration, opting instead for a tax on the manufacture and import of plastic packaging which has less than 30% recycled plastic content. However, Chancellor Philip Hammond said it would be "considered" again in the future if the government's wider policies fail to deliver increased recycling.

5. WHAT WILL SHAPE FUTURE MARKET DEMAND?

5.4 China National Sword

- As of 1st January 2018, China imposed an outright ban on import of post-consumer plastics, along with a ban on mixed ('unsorted') waste paper.
- While sorted waste paper grades remain permitted, the allowable level of contamination was reduced to a challenging 0.5% in March 2018 (compared to 1.5% previously).
- Over the first half of 2018, the recycling sector has had some success in securing alternative markets, with significant volumes sent to countries including Malaysia, Indonesia, Vietnam and Thailand.
- However, some countries which have seen expansion in recyclables imports have imposed their own restrictions – in particular plastic bans have now been put place in Vietnam and Thailand, with other countries potentially following suit.
- It is clear that some recyclers have had experienced disruption, and a WRAP survey of local authorities indicates that some plastics collected for recycling have been sent to EfW, or exported as SRF.
- Where recyclable materials – and in particular plastics – are temporarily diverted to EfW, concerns have been raised regarding the ability of receiving facilities to comply with chlorine emissions limits:
  - In this regard it should be noted that the chlorine content of recyclable plastic packaging is typically limited (indeed HDPE, PET and PP do not contain chlorine in their raw chemical form).
  - When incinerated, chlorine is converted into hydrogen chloride (HCl) and dioxins. These emissions are actively controlled by EfW facilities to achieve compliance with the requirements EU Industrial Emissions Directive (IED).
  - Incinerators in the UK consistently comply with emissions limits, even in cases where local authorities achieve low levels of recycling (with the likely consequence that the residual waste stream contains relatively high levels of plastic packaging).
  - In the event that EfW facilities were to accept batches of plastics originally intended for recycling, these would be blended in the bunker to produce a homogenous feedstock – likely diluting any chlorine content to levels which are not problematic.

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5.4 China National Sword *(continued)*

- A further consequence of 'leakage' of recyclables (particularly plastics) to the residual waste stream is an increase in the net calorific value of inputs to EfW facilities.
- The design envelope for EfW facilities (as defined by the respective firing / stoker capacity diagram) places an upper limit on heat input. An increase in the net calorific value of EfW feedstock can therefore require a reduction in the rate of mass input to the facility.
- As per comments above, it is notable that at present EfW facilities are successfully operated accepting residual waste feedstock from authorities which achieve a wide range of recycling rates. Feedstock net calorific values reported by operational faculties typically range from 8 to 10 MJ/kg.
- In the event of breakdown in recycling offtake arrangements, existing EfW facilities will have the capacity to absorb some increase in the net calorific value of throughputs. This may however be at the expense of a reduction in feedstock throughput, and therefore lower gate fee income.

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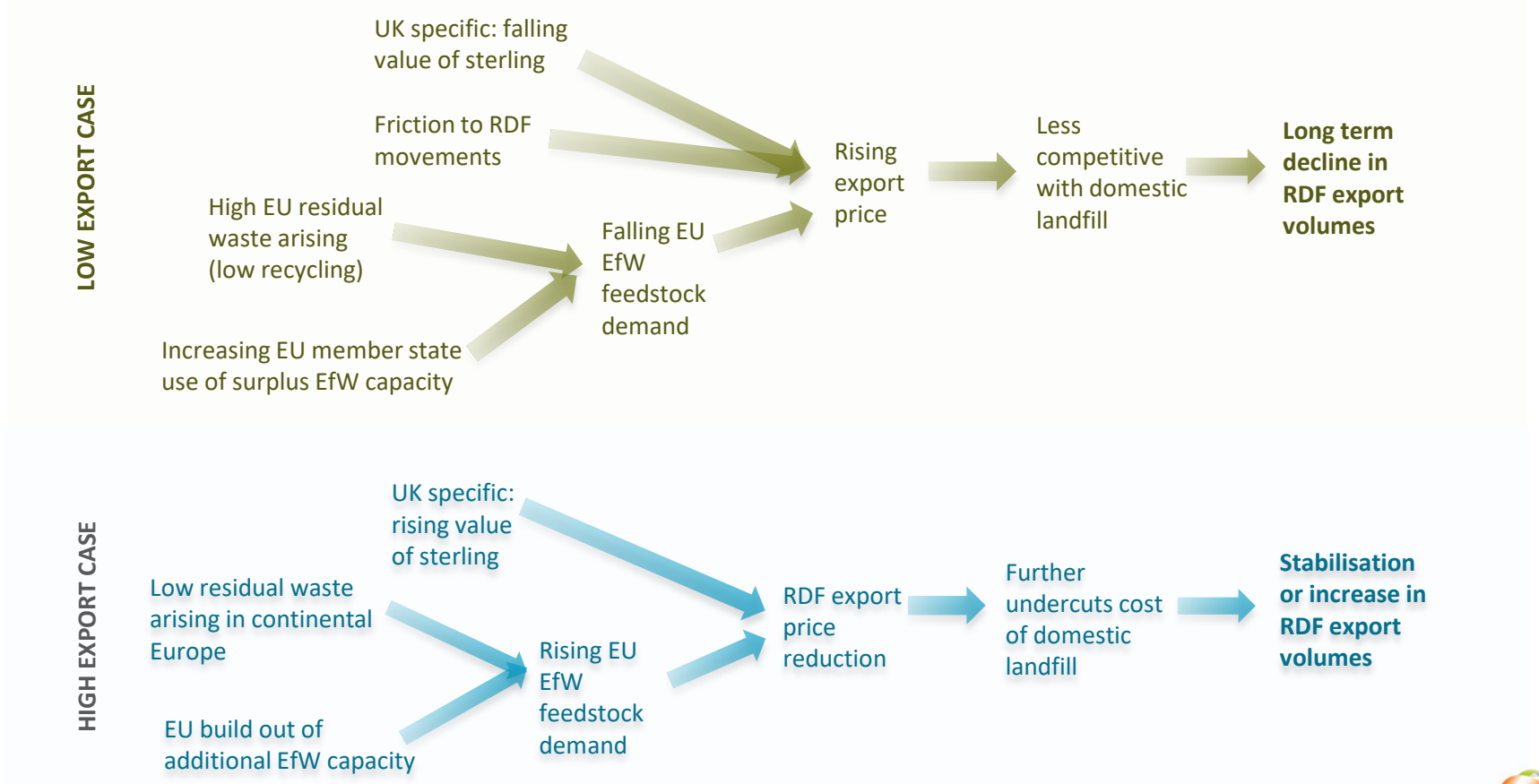
5. WHAT WILL SHAPE FUTURE MARKET DEMAND?

5.5 Combined Market Impact

- The future level of demand for RDF for import into Europe will ultimately be determined by the combined impact of the above factors.
- As a demonstration of these interactions, low and high RDF demand cases are illustrated schematically below.



6. EXPORT VOLUMES FUTURE GAZE

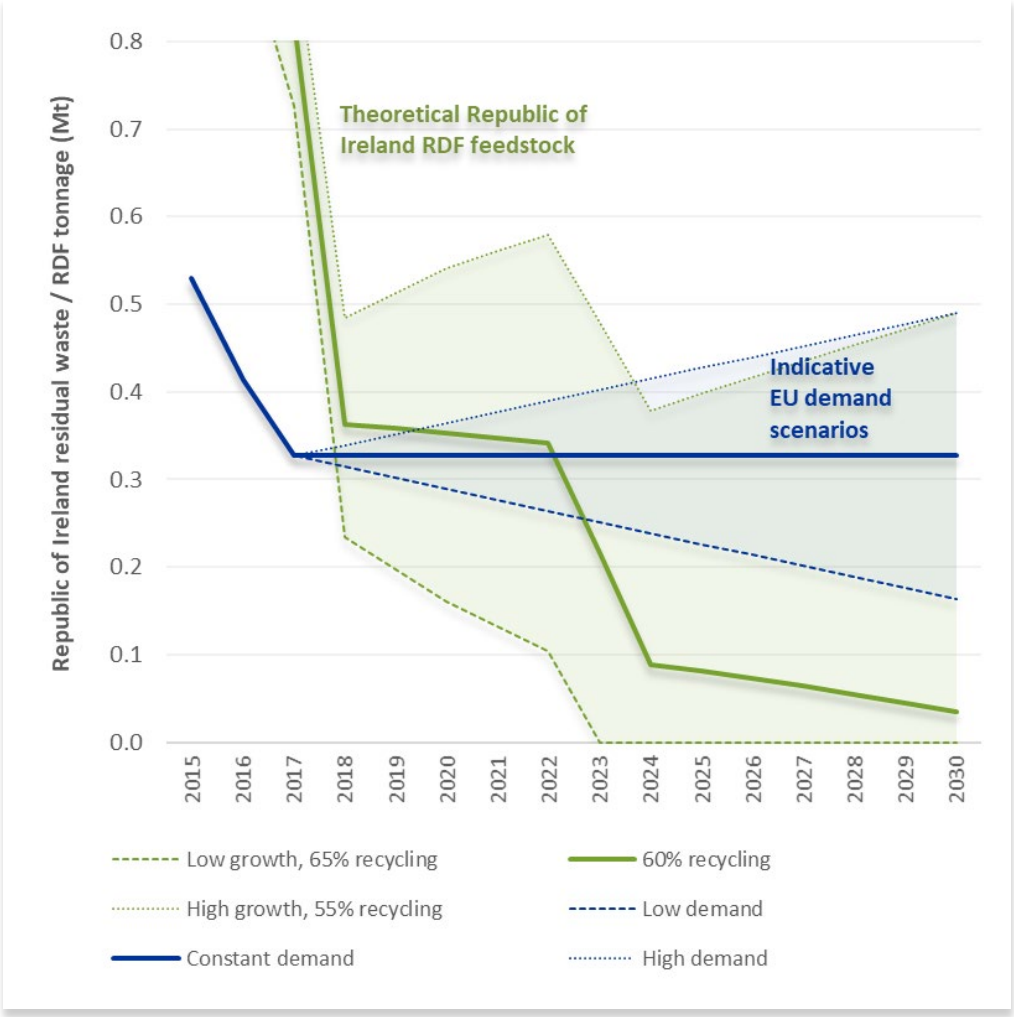
- Sections above demonstrate that the RDF market is subject to a range of influences, each of which are individually subject to a high degree of uncertainty – In this context, it is not possible to project the exact future scale of RDF exports with confidence.
- Nevertheless, some insight can be gained by considering the ultimate constraints to the level of exports:
  - Above, section 4 (domestic residual waste mass balance) estimates the ultimate residual waste treatment capacity gap in Republic of Ireland and UK – this is the ultimate '**supply side constraint**' to RDF export (since RDF exports cannot exceed the quantity of residual waste generated.
  - Section 5 evaluates a range of factors influencing future EU demand for RDF imports from Republic of Ireland, and the UK. Together, these factors combine to determine the ultimate '**demand side constraint**'.
- In the following slides, these supply and demand side constraints are overlaid for Republic of Ireland and the UK, indicating the ultimate 'envelope' within which RDF exports must fall.
- Key features of projections are as follows:
  - The theoretical **RDF feedstock (shown in green)** is equated with the capacity gap (as developed for Republic of Ireland and the UK in sections 4.1 and 4.2).
  - Indicative scenarios for **demand for RDF from the EU (shown in blue)** are then overlaid on supply. Here, three contrasting cases are considered:
    - Lower case -50% reduction in export relative to 2016 by 2030.
    - Constant case – with RDF exports remaining constant at the 2016 level.
    - Higher case +50% reduction in export relative to 2016 by 2030.

  Given the substantial uncertainties around EU RDF (for example due to Brexit and European waste management choices), these are intended as *illustrative scenarios only.*

6. EXPORT VOLUMES FUTURE GAZE

6.1 Republic of Ireland Projections

- The projected capacity gap (developed in section 4.1) indicates the ultimate supply side constraint to **Republic of Ireland feedstock (shown in green),** with three separate cases being considered allowing for variance in waste growth and recycling.
- As indicated above, future market uncertainties are such that EU RDF demand cannot be rigorously quantified. For illustrative purposes, here **EU demand (shown in blue)** is forecasted allowing for +/-50% variation relative to current levels, and a constant case.
- The Republic of Ireland currently has a relatively high reliance on RDF exports, with circa 40% of residual waste exported as RDF in 2017.
- Accounting for projected build out of new EfW capacity (and specifically, assuming the development of Ringaskiddy EfW), the remaining residual waste feedstock declines rapidly.
- On the assumption that recycling increases linearly towards the EU circular economy 60% target, the current (2018) capacity gap would theoretically be only marginally in excess of the 2017 RDF export level.



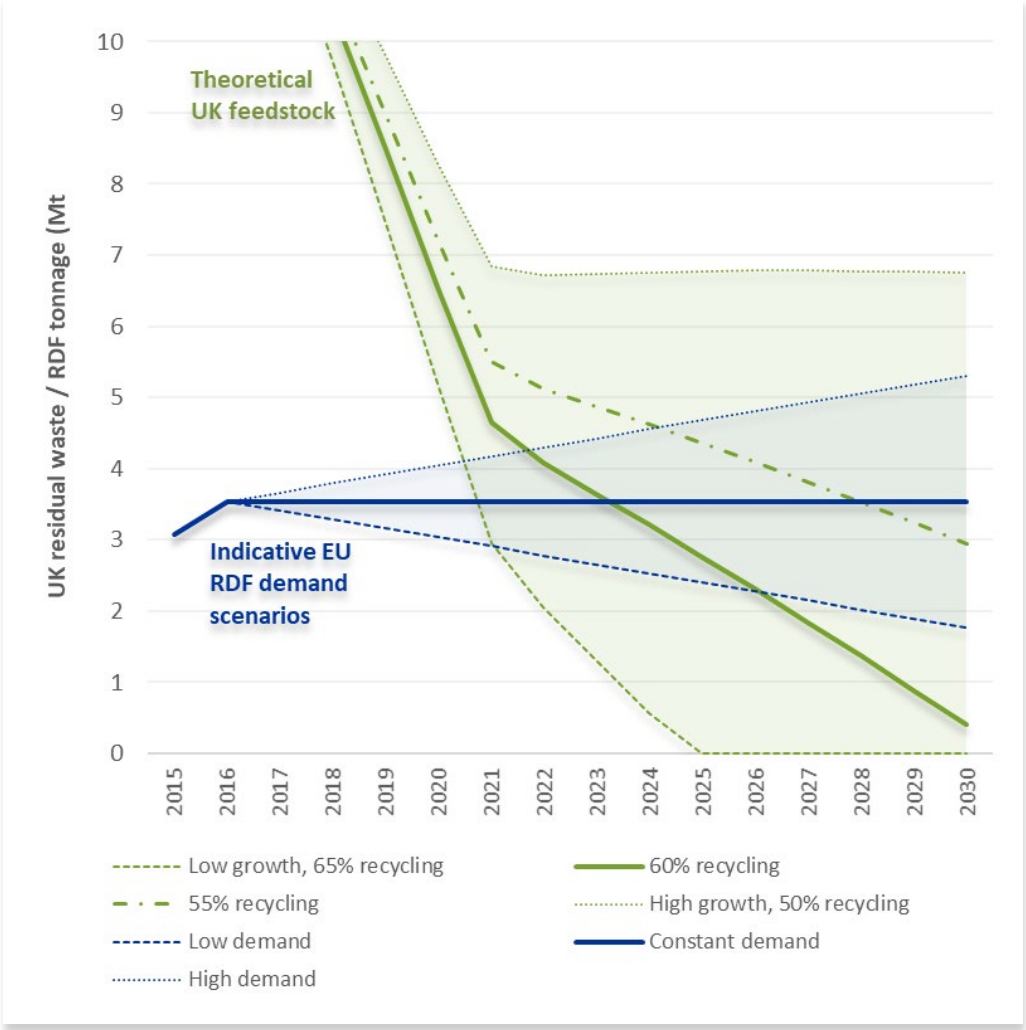
6. EXPORT VOLUMES FUTURE GAZE

6.1 Republic of Ireland Projections *(continued)*

- Conversely, in the event of higher waste growth, combined with 55% recycling by 2030 (i.e. falling short of circular economy targets), generation of RDF feedstock is not a significant constraint to exports in the short term.
- In practice, the export tonnage is likely to be impacted incrementally over time:
  - Even in the event that the capacity gap in the Republic of Ireland remains higher than current RDF exports, a short term 'shock' is possible, with export levels suppressed.
  - Assuming Republic of Ireland's commitment to the EU circular economy package, recycling levels are likely to continue to increase. Under this scenario, RDF exporters will compete to secure a gradually declining feedstock tonnage.
  - Nevertheless, given the proximity of major Irish population centres to ports, exporters may be well placed to offer export prices which are competitive with the cost of landfill.
  - The result may be export of an increasingly large proportion of the residual waste capacity gap tonnage, to some degree mitigating the overall decline in feedstock.

6. EXPORT VOLUMES FUTURE GAZE
6.2 United Kingdom Projections

- Opposite, the theoretical **UK feedstock (shown in green)** is equated the UK capacity gap (developed in section 4.2), with varying scenarios accounting for potential change in waste growth and recycling.
- As per the case of the Republic of Ireland, the requirement for RDF from the **EU (shown in blue)** is then indicatively projected with scenarios at +/-50% relative to current levels, and a constant case.
- As presented, RDF exports equate to circa 24% of the current UK residual waste treatment capacity gap – simple tonnage supply is therefore not currently a significant constraint to exports.
- However, assuming compliance with the EU CEP target of 60% recycling by 2030 (solid green line), constraint to residual waste feedstock supply will put significant downward pressure on export levels.
- Assuming a linear transition towards a 65% recycling rate by 2030 (dashed green line) – as originally proposed in the EU CEP but subsequently reduced – residual waste supply would rapidly place a hard limit on exports.



6. EXPORT VOLUMES FUTURE GAZE

6.2 United Kingdom Projections *(continued)*

- Conversely, forecasts indicate that under a high growth (5% increase in waste generation per capita), low recycling (50% recycling by 2030) case (dotted green line), the potential feedstock for RDF remains well in excess of the current export level, and therefore does not act as a constraint.
- UK findings therefore demonstrate that the future scale of RDF exports is critically sensitive to the ultimate recycling level achieved in the UK. It remains to be seen whether the new resources and waste strategy (indicated by Defra as to be released later this year) will reduce uncertainty in this regard.
- As per the case of the Republic of Ireland, the combined impact recycling and domestic EfW build out on RDF exports is likely to be complex, and vary over time:
  - Assuming a continuing stall in the English recycling rate, any increase in UK recycling will be gradual, despite expected improvements in Northern Ireland, Scotland and Wales.
  - Regardless of slow progress in recycling, with continuing build out of domestic EfW capacity in the short term (approximately through to 2022), a significant reduction in the capacity gap is expected (as shown in all scenarios in the figure above).
  - Over this timescale, the theoretical residual waste feedstock remains in excess of EU demand (taking the 3.5 Mt exported in 2016 as a proxy for this demand).
  - Nevertheless, this falling feedstock may put downward pressure on the exported tonnage. As the capacity gap falls, competition with domestic landfills will intensify – where the point of waste arising is remote from ports, large efficient landfills may remain cost competitive with RDF export. Furthermore, some landfill operators with in-house waste collections may make a strategic decision to make use of void, even at a higher cost.
  - In the absence of any significant increase in EU demand, and reduction in export prices, the expectation is downward pressure on exports, at least out to 2022.
  - In the longer term, assuming no longer term build out of domestic EfW projects, the outcome will depend strongly on the level of government commitment to increasing recycling in England.

6.2 United Kingdom Projections *(continued)*

- It should be noted that the approach taken above (for both the Republic of Ireland and UK) is a simplification. For example, in the case of a low RDF export price (high demand), development of domestic EfW capacity may be discouraged (increasing RDF supply). Demand and supply do not therefore evolve independently.
- Nevertheless this methodology clearly demonstrates that:
  - Downward pressure on RDF exports is expected in the short term due to rapid build out of EfW capacity.
  - The long term scale of RDF is highly sensitive to levels of waste growth, and in particular recycling rates achieved in UK and the Republic of Ireland.
  - Particularly in the UK, the current policy context creates an uncertain long term outlook for exporters.

7. HOW SHOULD THE INDUSTRY POSITION ITSELF?

- Analysis in previous sections indicates that the future of the RDF export sector is highly dependent on political and economic developments.
- Exports from the Republic of Ireland show a significant decline over the last two years, while the position of UK exports is somewhat precarious, being dependent on the Brexit outcome, and future national recycling performance.
- A range of organisations across public and private sectors are affected by the RDF export market, and will be impacted by future changes in export pricing and volumes.
- Taking each case in turn, the following aspects are considered:
  - The scale of impacts (both positive and negative) of RDF exports.
  - Commentary on these impacts.
  - Strategy considerations in the context of the evolving market.
- Where applicable, these areas are addressed separately for Republic of Ireland and the four UK administrations.

7. HOW SHOULD THE INDUSTRY POSITION ITSELF?

ORGANISATION	Public sector	National government		Impacts -ve	Impacts +ve	Comments on possible future RDF export market

			Republic of Ireland	■	■	**Strategy considerations** for national government
						• Particularly for the case of England, greater long term policy certainty is essential to allow the sector to adapt as the export market evolves.
						• From the UK side, any friction to RDF export flows (for example due to increased administrative burdens) would increase export costs. Under prevailing shipment regulations (and in particular EC No 1186/2009, which stipulates zero customs duty where goods have negligible value) it appears unlikely that a tariff would apply, though the RDF Industry Group wishes to cement this position.
						• In 2017 Northern Ireland exported 28 kt of RDF to the Republic of Ireland – clearly these operations may be impacted by the post-Brexit outcome for the Irish border.
						Negative impacts for national government
						Largely consistent across all countries and including:
						• Loss of baseload electricity supply to EirGrid / National Grid.
						• Loss of gate fee income to the domestic economy, as well as landfill tax income; and
						• Reliance placed on the EU RDF market, which may be subject to volatility (particularly relevant to Northern Ireland which currently has the greatest per capita export, and to a lesser extent Scotland, which may rely on exports to meet the 2021 ban on biodegradable material to landfill).
						Positive impacts for national government
						• The overriding benefit is diversion of material from landfill – often thought of as a holding position pending increases in recycling rates and build out of domestic capacity. This is particularly compelling in Scotland, and Northern Ireland:
						  • The Scottish 2021 ban on biodegradable waste to landfill is likely to be unachievable on the basis of Scottish domestic EfW capacity alone. Installation of basic RDF production equipment, with subsequent export, is an attractive solution, though some councils may also opt to transport waste to EfW facilities or landfills in the north or England.
						  • In the current absence of EfW capacity in Northern Ireland, RDF exports provide an invaluable route for landfill diversion.
						• Across all countries, RDF exports contribute to carbon reduction (against largely landfill), while providing some uplift to national recycling rates via materials capture at RDF preparation facilities.

			England	■	■■	
			Scotland	■■	■■■	
			Wales	■	■	
			Northern Ireland	■■■	■■■	

7. HOW SHOULD THE INDUSTRY POSITION ITSELF?

ORGANISATION				Impacts -ve	Impacts +ve	Comments on possible future RDF export market
	Public sector	Local authorities	Republic of Ireland	■	■	**Strategy considerations** for local authorities • Where reliance is placed on export, contracts should be structured to avoid exposure to pricing risk. • Authorities should also keep a watching brief on available merchant domestic EfW capacity. As the UK capacity gap closes, domestic pricing may become increasingly more competitive. **Positive impacts** for local authorities • A flexible and potentially economic solution (for councils not contracted to domestic EfW). • For Scottish authorities in particular, a rapidly deployable solution to meet the requirements of the 2021 ban on biodegradable waste to landfill. (It should however be noted that some Scottish Councils may also opt to transport residual waste to landfills or EfW facilities in the North of England.) • Specifically in Northern Ireland, potentially a relatively low cost disposal option in lieu of domestic EfW capacity. • Disposal solution with no long term constraint to recycling performance. (In this context it should be noted that, with the correct contract terms, use of domestic EfW does not necessarily imply a constraint). **Negative impacts** for local authorities • It is arguable that reliance on the shorter term RDF export market can stifle progression toward longer term self-sufficiency in treatment.
			England	■	■■	
			Scotland	■	■■■	
			Wales	■	■	
			Northern Ireland	■	■■■	
		Environmental regulatory agencies EPA, EA, NIEA, NRW, and SEPA		■■■	■	**Strategy considerations** for environmental regulatory agencies • Infractions by exporters (particularly in relation to storage) are more likely if export costs rise. **Positive impacts** environmental regulatory agencies • Solution to meet jurisdictions short term capacity shortfall. **Negative impacts** for environmental regulatory agencies • Monitoring and enforcement of storage and export conditions places an additional burden on resources. Infractions by exporters (particularly in relation to storage) are more likely if export costs rise. • In the event of a rising export cost (e.g. due to devaluation of the pound or post-Brexit customs requirements) some operators may become insolvent. This raises the possibility of 'orphaned RDF' with no viable commercial entity able to pay for disposal, and public sector organisations being left liable.

7. HOW SHOULD THE INDUSTRY POSITION ITSELF?

			Impacts		
			-ve	+ve	Comments on possible future RDF export market
ORGANISATION	Private sector	Waste collection companies	■	■	**Strategy considerations** for waste collection companies • Actively maintain discussions with a range of off takers to ensure continuity. **Positive impacts** for waste collection companies • Reduced disposal costs with a wider range of outlets. **Negative impacts** for waste collection companies • Possible disruption to offtake arrangements in the event of significant export cost rise (as may occur in the event of a Brexit worst case).
		Domestic EfW operators	■■■	■	**Strategy considerations** for domestic EfW operators • Seek to engage with RDF exporters to secure future feedstocks. • Aim to offer a level of contractual flexibility similar to that seen for export arrangements. **Positive impacts** for domestic EfW operators • The practice of RDF export has arguably been instrumental in establishing long range transport of residual waste as a market norm. • In particular, processing of residual waste to produce RDF will typically increase bulk density, making transport more economic. • The RDF export industry has arguably therefore reduced geographical barriers to feedstock accessibility. **Negative impacts** for domestic EfW operators • Increased competition for feedstock. • Possible downward pressure on gate fees.

7. HOW SHOULD THE INDUSTRY POSITION ITSELF?

			Impacts		
			-ve	+ve	Comments on possible future RDF export market
ORGANISATION	Private sector	RDF exporters – brokers	.	■■■	**Strategy considerations** for RDF exporters – brokers • In the event of a contracting export market, there may be potential to establish supply agreements with emerging domestic capacity (anecdotally, some exporters are already pursuing this option). • In a domestic EfW context, the greatest opportunities likely to be gasification, given the constraint of more stringent input specifications. **Positive impacts** for RDF exporters – brokers • Niche opportunity as an intermediary acting between waste aggregators, and European end users.
		RDF exporters – waste operators	.	■■■	**Strategy considerations** for RDF exporters – waste operators • As above, in the event of a shift away from export to use of domestic EfW capacity, opportunities may exist to participate in the domestic supply chain. **Positive impacts** for RDF exporters – waste operators • Many companies active in RDF preparation are existing transfer station operators who have installed RDF production equipment. In general, RDF preparation and export will be adopted because it is more economic than landfill disposal.
		European EfW end users	.	■■■	**Strategy considerations** for European EfW end users • In the event of declining exports from the Republic of Ireland and the UK, European operators may look increasingly to southern and eastern Europe to meet feedstock requirements. • The success of this approach will ultimately depend on the ability and willingness of other Member States to pay for this service. • This scenario (EfW self-sufficiency in Republic of Ireland and UK, combined with a net increase in landfill diversion across Europe) would give a positive outcome in carbon and energy terms. **Positive impacts** for European EfW end users • Continuing utilisation facilities, despite national overcapacity.

8. HEADLINE FINDINGS

- Analysis of RDF markets undertaken on behalf of CIWM shows dramatically different situations across the Republic of Ireland and the four UK administrations:

  - The **Republic of Ireland is likely to see a significant reduction in RDF export tonnages as new domestic EfW capacity is developed**, and recycling rates increase.

  - In England, build out of domestic EfW capacity may erode RDF export tonnages, while **future recycling levels are pivotal to the long term outlook for exports**. In the current absence of a national strategy to increase recycling levels, it is not possible to project the recycling rate ultimately achieved by England with any certainty – however it is clear that, accounting for expected domestic EfW capacity, achievement of circular economy recycling targets in England implies the cessation of large scale RDF exports.

  - **On a per capita basis, Northern Ireland has the greatest reliance on RDF exports,** and this reliance is likely continue until domestic EfW projects are successfully developed. Current exports to the Republic of Ireland may be impacted by the post-Brexit border settlement.

  - **Scottish local authorities may rush to expand RDF exports to meet the 2021 ban on landfill** of biodegradable waste – though some may also opt to comply via haulage of residual waste to EfW facilities or landfills in the North of England. In the longer term, Scottish residual treatment requirements are likely met by emerging Scottish EfW capacity.

  - With strong recycling performance and two major EfW facilities in the North and South, **Wales is likely to have limited reliance on RDF exports**. By specifically targeting residual waste treatment funding to domestic EfW projects, Welsh Government disincentives export.

8. HEADLINE FINDINGS *(continued)*

- For the case of the UK, there remains a **risk that the impacts of Brexit may weaken the economics of RDF export** (for example via the exchange rate, import tariffs, or friction to export movements):
  - Notwithstanding the possibility of a long term reduction in the requirement for exports (in the event that EU CEP recycling targets are met), **RDF exports are currently playing an important interim role in diverting waste from landfill** and thereby reducing carbon emissions attributable to the UK.
  - While differing market dynamics exist in Republic of Ireland and across the UK, in all cases disruption to export flows may have negative consequences in the short term. In the medium to long term, these impacts will be reduced by increasing indigenous EfW capacity.

9. REFERENCES

Market aspect	Data source	URL
RDF export tonnages – Republic of Ireland	National Trans-Frontier Shipments Office (NTFSO)	http://www.dublincity.ie/main-menu-services-water-waste-and-environment-waste-and-recycling-national-tfs-office/ntfso-waste
RDF export tonnages – England	Environment Agency	https://data.gov.uk/dataset/fb973a82-c484-4b14-8209-01bbea39c87b/international-waste-shipments-exported-from-england
RDF export tonnages – Northern Ireland	Department of Agriculture, Environment and Rural Affairs	https://www.daera-ni.gov.uk/publications/export-records-rdf-shipped-northern-ireland
RDF export tonnages – Scotland	Scottish Environment Protection Agency	http://apps.sepa.org.uk/disclosurelog_admin/uploads/F0186307_DOC6E295B3D76_f0186307%20data.xlsx
RDF export tonnages – Wales	Natural Resources Wales	http://lle.gov.wales/catalogue/item/TFSDataRDFWasteExportWales/?lang=en
Current UK gate fees for landfill RDF export and EfW	Price indicators compiled by letsrecycle.com	https://www.letsrecycle.com/prices/efw-landfill-rdf-2/efw-landfill-rdf-2018-gate-fees/
Historical UK landfill gate fees	Waste & Resources Action Programme	http://www.wrap.org.uk/collections-and-reprocessing/recovered-materials-markets/reports/gate-fee-reports
European RDF export flows	Eurostat prior written notification and consent dataset	http://ec.europa.eu/eurostat/web/waste/transboundary-waste-shipments

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